RUTOMOTIVE INDUSTRIES

AUTOMOTIVE and AVIATION MANUFACTURING ENGINEERING • PRODUCTION • MANAGEMENT

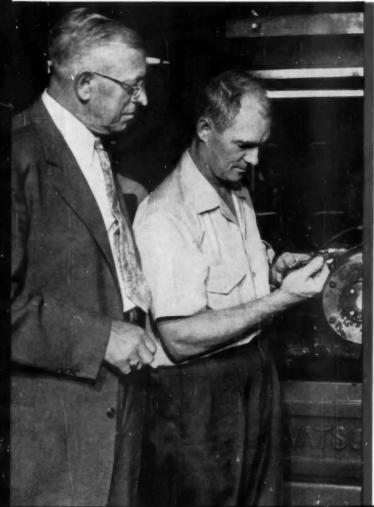
JULY 1, 1956

In This Issue

Engine Projects Unveiled at SAE Meeting Production Setup for the IHC V-8 Engine Expanded Resins for Aircraft Applications Facilities for Making Fuller Transmissions Vickers' Forum and Meetings of AGMA, ASQC The 1956 Material Handling Exposition

COMPLETE TABLE OF CONTENTS, PAGE 3

STANOIL Industrial Oil delivers on tough assignment at Indianapolis Screw Products Corp.



Rolling threads on aluminum bronze with pitch diameter tolerances as close as .0014" is a tough job but Indianapolis Screw Products Corporation is used to taking on such jobs and delivering. They give tough jobs to the hydraulic oil they use, too, and they expect it to deliver. They've given such a job to STANOIL and they're getting the results they expect—and more.

STANOIL Industrial Oil is used in the hydraulic system of a Watson-Flagg precision thread roller in the Indianapolis Screw Products Corporation plant. The system uses a Vickers pump and Cuno filter. The filter has not been cleaned in over a year because it hasn't needed cleaning. Here, as in other applications, STANOIL delivers top performance with minimum maintenance and maximum system cleanliness of the hydraulic system.

STANOIL likes tough assignments like this one; likes them because it can deliver with plenty to spare. Perhaps you would like to know about the use of STANOIL in a hydraulic application in your plant. In the Midwest and Rocky Mountain states, a lubrication specialist at your nearby Standard Oil office will be happy to discuss it with you. Call him. Or contact Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

Mr. R. W. Williams, Plant Superintendent checks pitch diameter of thread with Glenn Riggs, Standard lubrication specialist. Glenn Riggs is an old hand at helping industrial firms work out lubrication problems. Glenn has been doing this sort of thing for 28 of the 30 years he's been with Standard. This background and experience, customers have found, pay off for them.





Cuno filter (left) remains clean after more than year filtering STANOIL. Vickers pump on Watson-Flagg Thread Roll machine (right). Good housekeeping and STANOIL team to give top performance in this hydraulic system.

STANDARD OIL COMPANY

(Indiana)

"Back-up" power for straddle carrier torque converter drive



provides forward and reverse gears for this Gerlinger Model SC50 Straddle Carrier -- a boon to materials handling in rolling mills and steel plants!

This vehicle can quickly pick up heavy billets and bar stock, carry them at speeds up to 25 mph on smooth terrain, and unload in a matter of seconds! The torque converter transmission eliminates operator fatigue and provides a smooth flow of power through a wide range of torque and speed conditions. Uninterrupted, lowmaintenance operation is assured, too, because the Cotta Transmission is designed especially for reversing applications behind torque converters . . . to serve the heavy-duty power requirements of big equipment.

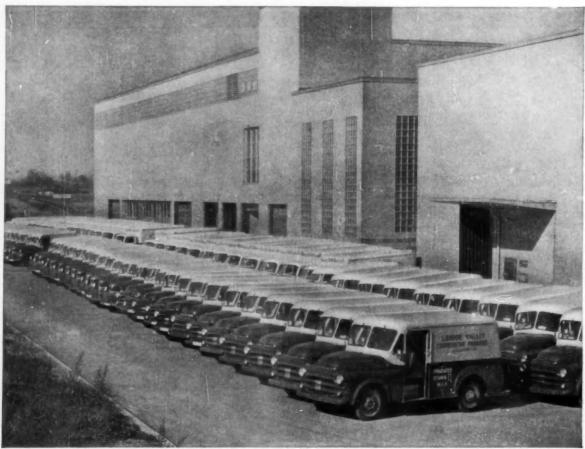
THIS INFORMATION WILL HELP YOU

Diagrams, capacity tables, dimensions, and complete specifications sent free on request. Just state your problem-COTTA engineers will help you select the right unit for best performance. May we work with you?

COTTA TRANSMISSION CO., ROCKFORD, ILLINOIS

If you build rail cars, winches, drilling rigs, trucks, hoists, or other heavy-duty mobile equipment, and are considering the application of torque converter drives, Cotta will build an "engineered-to-order" transmission to meet your specifications - a unit that will stand up under severe operating conditions for the life of your equipment.





A great fleet . . . with bodies able to take day-in day-out dairy route punishment. These bodies withstand the strains of stop-and-go driving, attacks of weather, water and general hard use, yet mainte-

nance is minimum. Because they are designed to utilize the properties combined in high strength low alloy seeds containing nickel. Built by Boyertown Auto Body Works, Inc., Boyertown, Penna.

Nickel alloy steel helps body builder provide more strength...per pound...per dollar

Light, strong and corrosion-resisting... the truck bodies for this fleet were designed by Boyertown Auto Body Works, Inc., to utilize properties of a money-saving structural material — high strength low alloy nickel-copper steel.

As-rolled, without heat-treatment, steels of this type show a 50,000 psi minimum yield point, or about 1½ times that of plain carbon structural steel. Sheet gauges may be cold formed into structural panels that cut weight substantially, without sacrifice of strength or safety.

In addition, high strength low alloy nickel-copper steels offer 4 to 6 times greater resistance to atmospheric corrosion than do carbon steels. Thus, they retain a high degree of original strength. They also offer superior resistance to shock, battering and abrasion. As a result, use of these nickel steels extends the life of fabricated structures.

Moreover, high strength low alloy nickel-copper steels readily respond to fabrication processes, including welding. These steels, containing nickel along with other alloying elements, are marketed under a variety of trade-names by leading steel companies.

Get full details in "Nickel-Copper High Strength Low Alloy Steels"... your manual for the asking. It discusses design factors that cut weight safely, explains why these alloy steels resist atmospheric and other types of corrosion, describes behavior in fabrication, and illustrates scores of applications. Write for this manual now.



THE INTERNATIONAL NICKEL COMPANY, INC. \$7. Well \$1.25

DUSTRIES RUTOMOTIVE

A CHILTON MAGAZINE

JULY 1, 1956

VOL. 115, NO. 1

FEATURES

	Special Crane for Chassis Frames	64
48	40th Annual Meeting of AGMA. By Thomas	
50		65
51		66
52		70
56	Vickers' Machine Tool Hydraulic Forum	96
	50 51 52	50 Mac New 51 Fuller's Expanded Facilities for Heavy Duty Transmission Production. By Joseph Geschelin 1956 Material Handling Exposition. By Charles 52 A. Weinert

NEWS PREVIEW

Ford Steps Up Free Piston Engine Research	33	Calendar of Coming Events	21
First Half Car Sales Destined for Near Record	33	High Spots of This Issue	31
Lower Car Prices Deemed Out of Question	34	News of the Automotive and Aviation Industries.	3
White and Reo Anticipate Higher 1956 Sales	34	Men in the News	41
GM and Ford Get Larger Shares of Car Output	35	Automation News Report. By Samuel Cummings	72
Retarders for Truck Axles May Need More Study	35	Machinery News. By Thomas Mac New	79
Car Distribution System Threatened	35	New Plant and Production Equipment	81
Four-Wheel Light-Truck Drive Offered by GMC.	36	Free Literature and Free Information Service	
Car Painting by Radiation Gun Visualized	37	New Automotive and Aviation Products	92
S-P. Curtiss Wright Situation	37	Metals. By William F. Boericke	94
Usage of Anodized Aluminum Increases	38	Observations. By Joseph Geschelin	91
Novel Tubular Axle Offered by Fruehauf	39	On Our Washington Wire	121
GM Dealer Bucks Sales Drop with Advertising	39	Shorties	

Business	Depart	ment	Staff		× ×	*	*			*			31
Chilton	Officers	and	Directors.								. 10		31
Advertis	ore' las	lav											130

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Rotor J-2L
Impact
Wrench
cuts time 23%

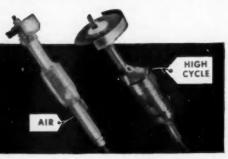
Formerly used electric nut setter for assembly of garden tools. Switch to Rotor J-2L Air-powered Impact Wrench cut job time 23%. Savings paid for tool in 12½ weeks.

New J-2L Impact Wrench is reversible . . . specially designed for minimum maintenance.

Find out how you can cut costs with the rugged, lightweight J-2L and other new Rotor Tools! Ask for Bulletin 41.

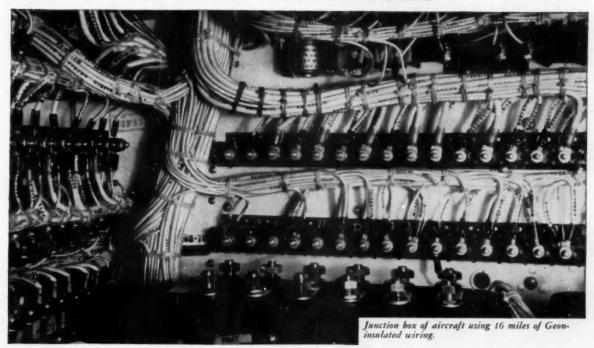
THE ROTOR TOOL CO.

CLEVELAND, OHIO



News about

B.F.Goodrich Chemical raw materials



For wiring that shrugs off water, chemicals, flame...



You can select wire and cable with Geon used either as primary insulation, or jacketing, or both. Many compounds available to meet specific requirements.

specify Geon insulation

EON-INSULATED wire and cable provides power dependability Gespite tough operating conditions.

Take water. Geon insulation tested by continuous immersion in water for three years showed no appreciable change in its excellent electrical properties. Geon has superior resistance to oils, resists most acids at all concentrations under many conditions. Geon compounds are flame resistant.

In physical properties Geon is likewise outstanding. Compounds aged outdoors for up to fifteen years have retained original properties. Geon is tough and abrasion resistant, keeps flexibility at very low temperatures.

Leading manufacturers offer Geon-insulated wire and cable for automotive and aircraft use, electrical equipment, machine tools, sig-

nal systems . . . wherever power dependability is important. For booklet giving complete data on Geon insulation properties, write Dept. DA-4, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.



B. F. Goodrich Chemical Company A Division of The B. F. Goodrich Company



B.F.Goodrich GEON polyvinyl materials • HYCAR American rubber and latex • GOOD-RITE chemicals and plasticizers • HARMON colors



Photo sequence shows impact cleat burying itself in the tread of a nylon cord tire. Nylon cord tires can take this punishment up to 300,000 times, while ordinary tires will stand only about one-fifth as many blows.

THERE'S EXTRA SAFETY IN NYLON CORD TIRES

Tires are among the components that can help make today's fine cars even safer. For our roads—whether superhighway or city street—are traveled to a point that tire failure of any kind is a potential danger.

- Nylon cord tires offer utmost safety, surest protection against tire trouble. Nylon tires have proved their superiority on military and commercial planes and on heavy-duty trucks. The people whose lives and livelihood depend on the ability of cars to perform at high speeds rely on nylon tires. Turnpike police, professional auto racers and high-speed test drivers are examples.
- Nylon cord tires reduce unsprung weight, and they readily absorb the added strains of power steering, braking, and higher horsepower.
- Nylon cord tires are among the components which contribute importantly to motor-car safety. They are the coming standard of the industry. As original equipment, they provide a valuable sales feature—extra safety.



BETTER THINGS FOR BETTER LIVING ... THROUGH CHEMISTRY

Du Pont produces the nylon fiber.

Tire manufacturers make nylon cord tires

—in tubeless or conventional types.

PRODUCTION with (BULLARD) "at all time Peak "

MAN-AU-TROL

Solar Aircraft Company of Des Moines, Iowa and San Diego, California, has found the versatility and flexibility of the Bullard Man-Au-Trol V.T.L., Model 75 a distinct advantage in the machining and fabricating of various jet aircraft engine parts and assemblies.

> Mr. Robert B. Ballard, Production Manager at Solar-Des Moines, reports that "with Man-Au-Trol, Model 75, it is possible to do a multitude of machining operations formerly requiring numerous expensive machines which had to be set up for a particular operation, so limited in scope, that an engineering design change either obsoleted the tooling or the machine. With Man-Au-Trol, Model 75, because of its wide range of functions, this obsolescence is greatly reduced - if there is a design change, only a new set-up is made - not the purchase of a new multi-thousand

> > dollar piece of machinery.'

These same advantages can be applied to your manufacturing methods -

Ask your Bullard Sales Engineer for complete details.



THE BULLARD RIDGEP

BULLARD COMPANY 286 CANFIELD AVENUE . BRIDGEPORT 9, CONNECTICUT

Please send me a copy of the NEW MAN-AU-TROL V.T.L., MODEL 75 CATALOG

NAME. COMPANY POSITION ADDRESS.....

ZONE STATE

Automatic Handling Speeds Production

On a Standard Ex-Cell-O Precision Boring Machine

For a Fraction of Special Machine Cost

This standard Ex-Cell-O Precision Boring Machine is equipped for facing both ends of oil pump impellers. With automatic work handling equipment it operates at a net production rate of 156 pieces per hour. The use of a standard machine keeps the original cost at a minimum.

In a completely automatic cycle a loading arm

picks a part from a chute and loads it into the chuck, then the parts are clamped, machined and ejected.

Ex-Cell-O Style 2112-8 Precision Boring Machine equipped with a single work spindle and special work handling devices for automatic loading,

XLD

The flexibility of standard Ex-Cell-O Machines permits low cost automated operation with the addition of work handling equipment. Such a machine may be profitable in your plant. Wire or write Ex-Cell-O in Detroit.

In straddle facing oil pump impellers (at right) smooth machine performance is imperative. Width limits between faces are held to .0005".

EXCELL-0

achining and ejecting.



The loading arm is about to load the part into the chuck. After machining, part is ejected into chute in foreground.

EX-CELL-

CORPORATION DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DETAIL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

56-17





How to heat vehicles?

Q: Chilly day at Thule (-50°F.)...how to start fire-crash truck within seconds, provide 90,000 Btu/hr. in small space?

A: Janitrol liquid heater (tested to -65°F.) keeps engine ready to go, provides cab and cargo heating too!



Q: How to find money to build heated storage buildings for Diesel bus fleet?

A: No need to find it, park the fleet outside —Janitrol liquid heaters keep engines, and bus interiors warm, ready to go at a fraction of cost of new building.

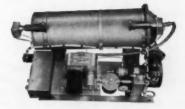


A

A: Call on Janitrol. If there's a need for heat for the job anywhere, chances are Janitrol can supply it, or build it from service-proved components.

Ever since designing and manufacturing the first successful heaters for aircraft 14 years ago, Janitrol has built thousands of heaters for aircraft and ground vehicles.

Today the name Janitrol stands for leadership in heating equipment and combustion engineering. Your Janitrol representative is always at your service.





AIRCRAFT-AUTOMOTIVE DIVISION, SURFACE COMBUSTION CORPORATION, COLUMBUS 16, OHIO

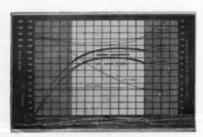
DISTRICT ENGINEERING OFFICES: NEW YORK, 225 BROADWAY; WASHINGTON, D. C., 4650 EAST-WEST HIGHWAY; KANSAS CITY, 2201 GRAND AVE.; FORT WORTH, 2509 BERRY ST.; HOLLYWOOD, CALIF., 7046 HOLLYWOOD BLVD.; COLUMBUS, OHIO, 400 DUBLIN AVE.

MORE WORK DONE, LESS MAINTENANCE

-these benefits are built in TORCON

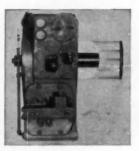
Torque Converters





* Engine efficiency and torque demand in constant balance...

Torcon design provides that the engine will operate at its most efficient speed, with torque multiplication to meet constantly changing demands. Torcon blade design eliminates cavitation, assures high efficiency throughout a wide working range.





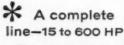
* Integrated oil system...

Oil sump is an integral part of the housing casting an important advantage. Internal oil passages are cast in the housing—reducing the number of parts, eliminating unnecessary hoses and fittings, preventing leakages that impair efficiency. Oil flows automatically to lubricate all working parts.



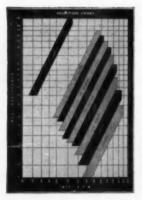
* Easy accessibility...

Ample sized cover plates are easily removable for quick inspection—no special tools required. Regulating valves are mounted on the outside of the housing, for immediate inspection.



Torcon torque converters include massproduced standard package units available to equipment manufacturers and to owners and operators for field installation.

A broad range of wheel diameters and options assures a unit that can be fitted readily into any power-transmission system.



THIS BULLETIN WILL BE HELPFUL

A brief, clear statement of Torcon features—well illustrated. Use the coupon.

CLARK' EQUIPMENT

CLARK EQUIPMENT

Jackson, Michigan

CLARK EQUIPMENT COMPANY, Falahee Road, Jackson 2, Michigan Please send me the Torcon Bulletin	Transmission Division
NAME	POSITION
FIRM	
ADDRESS	
CITY	ZONESTATE





Mahon Oven Control Cabinet, which houses Temperature Re-corder, Air Flow Switches and other Safety Control Devices, is shown at left. Mahon Oven Heating Unit appears in foreground.

Pinched for Space Inside? . . . there's LOTS of SPACE ON THE ROOF!

Abave is the 700-Foot Long Self-Housed Finishing System Planned, Engineered and Built by Mahon on the Roof of the Whirlpool-Seeger Corporation's Marion Division Plant, Marion, Ohio, Much of the housing in this installation is an integral part of the Finishing Equipment.

Here's a typical example of straight-line finishing production unfettered by restrictions normally encountered inside manufacturing plants. This Finishing System was planned, engineered and built by Mahon on the roof of the Whirlpool-Seegar Corporation's Marion Division Plant, Marion, Ohio . . . it was built on the roof because suitable space inside the plant was not available. In the 700-foot long enclosure, which is permanent construction, are housed a Seven-Stage Metal Cleaning and Rust Proofing Machine, a Dry-Off Oven, a Cooling Tunnel, a Flow-Coater and Vapor Conditioning Chamber, Reinforcing Booth and Filtered Air Supply System. The Finish Baking Oven, which was already in place, was rebuilt by Mahon with three new Heating Systems. This is a Mahon solution of a problem confronting one manufacturer. If you have a finishing problem, or are contemplating new finishing equipment—for either Electrostatic Coating, Spray Painting, Flow-Coating or Dip-Coating-you, too, will find that Mahon engineers are better qualified to advise you on both methods and equipment requirements. No matter what your finishing job may be, you'll find that Mahon equipment will serve you better . . . because, Mahon equipment is engineered better and built better for more economical operation over a longer period of time. You can rely on Mahon to do the complete job on one contract—undivided responsibility for the entire system insures proper coordination, and safeguards you against complications which may upset your production schedules. See Mahon's Insert in Sweet's Plant Engineering File, for information, or write for Catalog A-656.

THE R. C. MAHON COMPANY . Detroit 34, Michigan SALES-ENGINEERING OFFICES in DETROIT, NEW YORK and CHICAGO

Engineers and Manufacturers of Complete Finishing Systems—including Metal Cleaning, Pickling and Rust Proofing Equipment, Hydro-Filter Spray Booths, Dip and Flow Coaters, Filtered Air Supply Systems, Drying and Baking Ovens, Cooling Tunnels, Heat Treating and Quenching Equipment for Aluminum and Magnesium, and other Units of Special Production Equipment.

Precision Bores and Faces Diffuser Cases

Another Special by Cross





This Two-Way Boring Machine roughs, semi-finishes and finishes the accessory drive shaft hole of Jet Engine Diffuser Cases at the rate of 2½ pieces per hour. The operator places the part in the work holding fixture and the rough boring cutters in the boring spindles, after which the rough boring is performed automatically. Next, the operator replaces the rough boring cutters with semi-finish boring cutters and the cycle is repeated for the semi-finish boring operation. Then, the finish boring operation is performed in a similar manner and the part is removed.

The cutters are supported in live precision bearing spindles, which are in turn supported by hardened and ground steel bushings adjacent to the work.

All cutters are pre-set for size and are quickly and easily changed for the different operations.

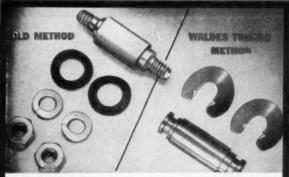
To provide maximum flexibility for future part design changes, the machine is built with Cross Modular "Building Block" Units.

Established 1898

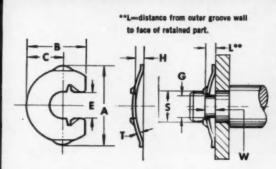
THI

First in Automation
DETROIT 7, MICHIGAN

New Waldes Truarc <u>locking-prong</u> ring functions as spring, shoulder, fastener...and <u>STAYS PUT!</u>



Above assembly shows how 2 Waldes Truarc Locking-Prong Rings (Series 5139) replaced 6 parts...eliminated threading operation... and need for skilled labor.



WALDES TRUARC LOCKING-PRONG RING (Series 5139)

Ring	SH	AFT				R	INC	DI	MEN	SION	15				average		GROC	VE D	IMENSI	ONS		resilient
No. 5139-	Dia.	tel.	A	tol.	8	tel.	c	tel.	E	tel.	н	tel.	ηf	tol.†	ohaar	Gia.	tol.	Width	tel. 000	£ min.	L max.	take up L max- L min
12	.125	±.002	.340	±.010	.307	±.010	.166	±.005	.086	±.004	.050	±.010	.010	±.0013	400	082	±.0015	.045	+.005	.035	.045	.010
±15	.156	±.003	.380	±.010	.330	±.010	.184	±.005	.108	±.004	.055	±.010	.010	±.0013	600	.104	±.002	.050	+.005	.035	.045	.010
18	.188	±.003	.445	±.010	.390	±.010	.213	±.005	.130	±.005	.060	±.010	.015	±.0015	900	.124	±.002	.065	+.005	.045	.055	.010
25	.250	±.003	.581	±.010	.500	±.010	.280	±.005	.172	±.005	.070	±.010	.015	±.0015	1000	.165	±.002	.070	+.005	.050	.065	.015
31	.312	±.003	.744	±.010	.620	±.010	.360	±.005	.234	±.005	.095	±.010	.018	+.001	1300	.228	±.003	.080	+.005	.080	.095	.015
× 37	.375	±.003	.853	±.015	.740	±.010	.427	±.005	.280	±.005	.130	±.010	.020	±.002	1900	.270	±.003	-	+.005	.090	.115	.025
±43	.438	±.003	.960	±.020	.820	±.020	.475	±.010	.337	±.010	.130	±.010	.020	±.002	2200	.327	±.003	.105	+.005	.095	.120	.025

Additional Sizes Under Bevelopmen

★Production dies not available as of date of printing

†Applies to unplated rings only

*Recommended safety factor -3 to 4.

The Waldes Truarc Locking-Prong Retaining Ring is a new, low cost, radially applied fastener which can be locked positively in its groove and used as a shoulder against rotating parts. It is primarily intended for use in the automotive, electronic and aeronautical industries.

This radially applied ring locks positively in its grooves by means of two prongs at the open end. Because of its high thrust-load capacity the Waldes Truarc Locking-Prong Ring may be used as a shoulder against rotating parts. Its bowed construction provides for end-play take-up in the assembly and makes less critical the tolerances required for the parts being fastened. Since it serves as a spring as well as a shoulder, this ring eliminates the need for springs, washers, and other accessory fastening devices.

Whatever you make, there's a Waldes Truarc Retaining Ring

designed to improve your product...to save you material, machining and labor costs. They're quick and easy to assemble and disassemble, and they do a better job of holding parts together. Truarc rings are precision engineered and precision made, quality controlled from raw material to finished ring.

36 functionally different types...as many as 97 different sizes within a type...5 metal specifications and 14 different finishes. Truarc rings are available from 90 stocking points throughout the U. S. A. and Canada.

More than 30 engineering-minded factory representatives and 700 field men are available to you on call. Send us your blueprints today...let our Truarc engineers help you solve design, assembly and production problems...without obligation.



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WALDES

TRUARC

Waldes Kehineer, Inc., 47-16 Austel Place, L.I.C. 1, H.Y.

Please send me sample Locking-Prong Rings.
(please send me supplement No. 1 which hold

Please send me supplement No. 1 which brings Truorc Catalog RR 9-52 up to date. (Please print)

Name.

Company

Business Address.

Zone State Ayurs

WALDES TRUARC Retaining Rings, Grooving Tools, Pliers, Applicators and Dispensers are protected by one or more of the following U. S. Patents: 2,382,948; 2,411,426; 2,411,761; 2,416,852; 2,429,221; 2,428,341; 2,439,785; 2,441,846; 2,455,165; 2,483,379; 2,483,380; 2,483,383; 2,487,802; 2,487,803; 2,491,300; 2,491,310; 2,509,081; 2,546,616; 2,547,263; 2,558,704; 2,574,034; 2,577,319; 2,595,787; and other U. S. Patents pending. Equal patent protection established in foreign countries.



WE DON'T STOP WITH THE DELIVERY OF A CHEMICAL —

we put it to work and keep it working effectively

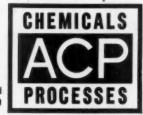
The chemical treatment of metals and manal parts—to prepare them for further processing, to protect them, to beautify them—has grown from a haphazard operation to a highly technical one. Supplying the chemical ingredients is a relatively simple job. Putting them to work and keeping them working effectively in your plant demands the skill of an experienced organization. We have that organization.

We supply not only the metal-treating chemicals, but also—free of charge—the technical and engineering service to keep them working at top efficiency. We furnish assistance in developing and installing the process, we maintain continuing inspection of the process and equipment if you so desire, we check samples of the processed metals in our Quality Control Laboratories—all these are part of the ACP service at your command.

That's why we say, "We don't stop with the delivery of a chemical—we put it to work and keep it working effectively." And we have been doing this for over 40 years. Write for a booklet describing ACP products and services.

AMERICAN CHEMICAL PAINT COMPANY Ambler 24, Pa.

DETROIT, MICHIGAN NILES, CALIFORNIA ST. JOSEPH, MISSOURI WINDSOR, ONTARIO



Some of the many ACP processes and chemicals used in the treatment of metals

PAINT BONDING

Granodine® forms a phosphate coating base on iron and steel products—provides an excellent bond for paint, and greatly improves the corrosion resistance of the paint system.

Alodine® forms an amorphous film on aluminum which protects the metal and anchors the paint finish. Alodized aluminum meets service specifications.

Lithoform® promotes a good bond for paint on galvanized iron, zinc and cadmium plated surfaces. Also prevents any objectionable chemical reaction between applied paint film and the metal surface. One grade of Lithoform, in itself, provides excellent corrosion resistance on zinc and cadmium.

PROTECTION FOR FRICTION SURFACES

Thermoil-Granodine® forms a manganese iron phosphate surface which materially reduces wear and minimizes galling by eliminating metal-to-metal contact. It is particularly effective during break-in period of bearing surfaces.

RUSTPROOFING

Permadine®—a zinc phosphate coating chemical—forms a heavy oil-adsorptive crystalline coating on steel. Bonds paint or such rustinhibiting oils as Granoleum®.

Thermoil-Granodine®—a manganese iron phosphate coating chemical—forms on steel a dense crystalline coating which, when oiled or painted inhibits corrosion.

IMPROVED DRAWING AND COLD FORMING

Granodraw® for steel, Granodraw SS for stainless, and Alodine® for aluminum for an integral coating with the base metal which facilitates the cold mechanical deformation of the metal, improves drawing characteristics and lengthens die life.

A pioneer in the development and servicing of metal treatment processes

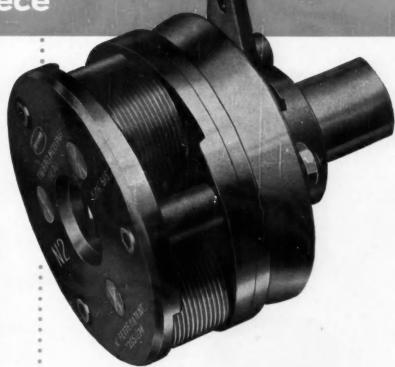
Acme-FETTE

Cuts threading costs to \$0.0003 per piece

On an automotive part that required millions of duplicate pieces, one manufacturer found that the application of Acme-Fette thread rolling heads enabled him to:

- Get required production with 9 Acme-Gridley bar automatics instead of 14.
- Secure better threading results with rolled threads which provided smoother, tougher threaded pieces.
- Show a unit threading cost of 3 one-thousandths of a cent.
- Reduce total cost per piece more than 33½% while producing in excess of 35,000,000 pieces.

Why not check Acme-Fette advantages on your threading jobs?



New Acme-Fette Type N self-opening thread rolling heads are used with either rotating or non-rotating spindles. They let you complete threaded jobs on your present turning equipment without rehandling — roll threads 5 times faster than thread cutting methods (and with no chip problem).

National Acme

THE NATIONAL ACME COMPANY, 173 EAST 131ST STREET, CLEVELAND & OHIO

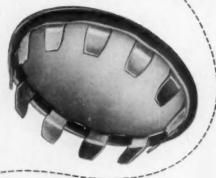
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IT'S A "SNAP" to make a tight seal

with DAREX Flowed-in Gaskets





W506 COMPOUND — one of several standard DAREX "Flowed-in" compounds now being used by the automotive industry.

Base: Buna

Adhesion to metal: Good

Heat Resistance: 0°F to 250°F

Oil Resistance: Good

Aging: Excellent

Permanent Set: 30%

Curing Time: 20 Minutes

Consistency: Uniform sponge

Uses: Metal to metal seals against water, dust, dirt, fumes, vibration When "snap-in" parts are pre-gasketed by the DAREX "Flowed-in" Gasket Process:

 You get a tight seal that prevents vibration, seals out water, dust, dirt and fumes

You save by eliminating costly hand assembly of gasket to part

You know that there's no chance for a worker to drop or forget the gasket

Knock out plugs and electric socket housings typify a whole family of "snap-in" parts on which automotive manufacturers are saving thousands of dollars yearly by using the new DAREX "Flowed-in" Gasket Process.

The DAREX "Flowed-in" Process is ingeniously simple. A DAREX gasketing compound is machined-flowed directly onto the part. This "flowed-in" compound is then cured to form a solid, rubbery gasket which becomes integral with the part. Since part and gasket are joined as one unit, your assembly line installation is speeded up. And you get a positive seal at lower cost than ever before.

Send today for the DAREX "Flowed-in" Gasket Brochure. In pictures and text, it shows a variety of applications in which this fresh approach to industrial gasketing can save motions, time and money for you!

DEWEY and ALMY

Chemical Company

DIVISION OF W. R. GRACE & Co.

Cambridge 40, Massachusetts

Dewey and Almy does not make the "snap-in" parts shown. We supply their manufacturers with gasketing compounds and machines to apply them.

.8.

VALUABLE DIE-SET DATA FOR ALL TOOL ENGINEERS It's easy-to-look-at! More than 200 pages are specially edited and arranged for quick and simple reference. Full color is

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It's easy-to-look-at! More than 200 pages are specially edited and arranged for quick and simple reference. Full color is used to make tables easier to read, illustrations more clear. The easy-to-look-at format plainly indicates all optional features. Covering the complete Danly "Leadership Line", this catalog presents full dimensional data and specifications for all Danly Die-Sets, Diemakers' Supplies, Bolster Plates and Bolster Plate Accessories. Get your copy of this new easy-to-look-at Danly catalog. Write for it today.

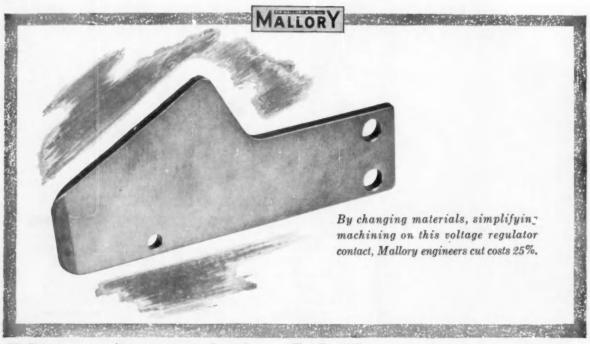
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Value Analysis by Mallory Saves Money on Contacts

Mallory Contact Engineering Offers Five Ways To Improve Economy

- The most effective contact material from the extensive line developed by Mallory. More economical alloys often can satisfy actual service conditions.
- The most economical contact design... for your purchasing, production and product needs.
- 3. The most economical backing material . . . from a group of Mallory alloys developed for this use.
- The most economical backing member design in relation to contact and product design requirements.
- 5. The most economical method of assembly of contact and backing member.

By coordinating all these important elements of contact design, Mallory can help you put into effect a long-range plan for cutting contact cost and assuring peak performance.

BETTER not take electrical contacts for granted. There's much more to contact design than meets the eye. Often Mallory engineers can, through a detailed analysis of requirements, recommend changes that amount to real savings.

The contact shown here, for a substation transformer voltage regulator, illustrates how deeply Mallory engineering penetrates into contact design. First step after scrutinizing all aspects of the application, was to change the material to Mallory Elkaloy® A. This change gave a more economical alloy to work with... at no sacrifice of performance for the intended use. Then, Mallory specialists recommended simplifications in manufacturing. Instead of a double disc finishing operation, they used a rolled-finish product... with less waste, less cost. Also eliminated as unnecessary to the desired service were three complete operations: sanding of the entire edge of the piece, and counterboring of holes for hold-down bolts and buffing of the chamfered end.

The contact is now being manufactured under simplified specifications, free of unnecessary "frills"—and gives equal performance at 25% less cost!

This is the kind of thorough, cost-conscious engineering that Mallory can apply to your own electrical contact designs. Our extensive experience in contact alloys, contact design and contact assembly engineering is ready to serve you. Write or call Mallory for a consultation.

Expect more ... get more from



Serving Industry with These Products:

Electromechanical—Resistors • Switches • Tuning Devices • Vibrators

Electrochemical—Capacitors • Rectifiers • Mercury Batteries

Metallurgical—Contacts • Special Metals • Welding Materials



New thermocouple extension wire flame-proof, weather-proof

. . . available through your



Here's a thermocouple extension wire with superior insulation. Each of the two solid conductors is insulated with .015" polyvinyl, and the pair is further protected by an outer .02" polyvinyl jacket. It's the ideal wire for even the toughest service. What makes it better than ever is a new kind of polyvinyl insulation that gives these qualities:

Won't become tacky or stick to conduit walls, even when overheated.

Won't support flame. Fire merely chars the coating. You can rewire without replacing the conduit.

Abrasion-resistant. Jacket won't break or fray in roughest service.

Easy to pull through conduit because jacket is smooth.

 REFERENCE DATA: Write for Specification \$002-1, and for Pyrometer Supplies Buyers' Guide No. 100-6. Weather-proof . . . double vinyl insulation gives extra protection.

Moisture-resistant. Completely moisture-resistant.

Flexible. Can be flexed safely . . . will not crack or split.

Ask your local HSM (Honeywell Supplies Man) to tell you about this new wire . . . and to discuss how the HSM Plan can bring new convenience and economy to all your pyrometer supplies purchases. Call him today, at your local Honeywell office . . . as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR Co., Industrial Division, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

Honeywell

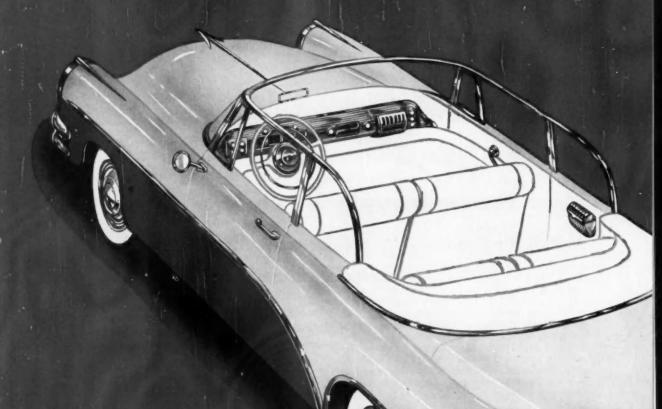
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Trim lines effectively accented with stainless steel
have brought to the modern motor car the equisite beauty
once reserved for only the finest limousines.
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enamel, for corrosion fighting stainless steel keeps its new car
brilliance years longer, even under the toughest road conditions. Discerning designers and stylists are converting more and more car parts

to stainless — and an increasing number of
these parts are fashioned from Sharonsteel.
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they can expect a better finish and a more
consistent quality — coil after coil —
when they specify "Sharon Stainless Steel."

ALONG THESE LINES



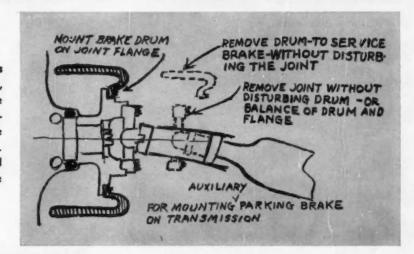
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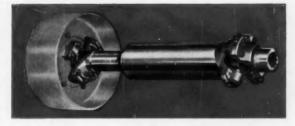
Successful Stylists

SHARON STEEL CORPORATION SA

Prevent Run-Away Trucks-THIS EASY WAY

Truck manufacturers found that serious accidents, caused by run-away trucks, can be prevented by improving the auxiliary parking brake on the transmission. The problem was to mount the brake drum on the universal joint flange. MECHANICS engineers studied and solved the problem — as shown in the sketch at the right.



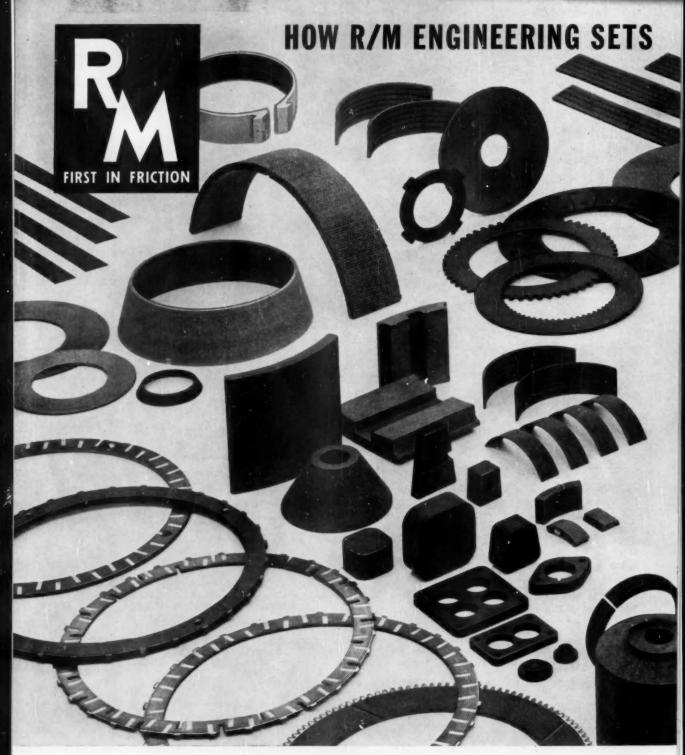


If you have a transmission mounting, space, torque, balance or other problem — you are invited to utilize the extensive experience of MECHANICS universal joint engineers.

Note that the brake drum is mounted directly on the flange of the universal joint. Also note that the brake drum can be removed for servicing the brake without disturbing the universal joint — and the joint can be removed without disturbing drum or the balance of the flange or drum.

MECHANICS UNIVERSAL JOINT DIVISION Borg-Warner • 2024 Harrison Ave., Rockford, III. Export Sales: Borg-Warner International 79 E. Adams, Chicago 3, Illinois

MECHANICS Roller Bearing UNIVERSAL JOINTS For Cars · Trucks · Tractors · Farm Implements · Road Machinery · Aircraft · Tanks · Busses and Industrial Equipment



A few of the many friction parts R/M makes of woven and molded asbestos, cork-cellulose, semi-metallic, sintered metal, and other friction materials. Raybestos-Manhattan has been the world's leading maker of friction parts for over 50 years. Unlike other manufacturers, R/M works with all types of friction materials . . . so that you can be sure of getting a completely unbiased recommendation whenever you consult an R/M engineer.

THE RECORD OF "FIRSTS" IN FIRST Woven Brake Lining . FIRST Asbestos Brake Lining . FIRST Ground Wearing Surface . FIRST Zinc Alloy Wire FRICTION MATERIAL DEVELOPMENT Brake Lining . FIRST Pre-Treated Yarns . FIRST Extruded Pulp Brake Lining . FIRST Flexible Pulp Brake Lining SHOWS WHY R/M IS

In Rolls • FIRST Dry Process Brake Lining • FIRST Semi-Metallic Brake Lining • FIRST Bonded-to-Metal Brake
Lining • FIRST Woven Clutch Facings • FIRST Molded Asbestos Clutch Facings for Clutches Operating in Oil FIRST IN FRICTION FIRST Endless Woven Clutch Facings • FIRST Pre-Treated Clutch Facings • FIRST Bonded-to-Metal Clutch Facings

THE PACE IN FRICTION MATERIAL DEVELOPMENT

THE TRADE-MARK THAT SPELLS PROGRESS IN

R/M alone manufactures all types of friction materials

Particularly with today's more complex requirements, no single type of friction material can be best for all friction applications. That's why R/M (and only R/M) manufactures all types of friction material. And that's why you can be sure of getting the material or combination of materials best for you when you consult R/M.

Where asbestos is most practical for your purpose, R/M experience can determine precisely whether woven or molded asbestos parts—or both together—will give you better performance. R/M's experience with asbestos is second to none in the field.

Where kinetic energy absorption per square inch of friction material is very high, where engagements occur on a repetitive cycle with little time interval, or where friction components must be held to a minimum thickness, R/M sintered metal friction parts, for oil or dry operation, may best meet your requirements. Under such severe conditions, R/M sintered metals will perform without appreciable increase in wear rate because of their high thermal conductivity and the absence of a destructible bond.

If high temperatures are not a factor, R/M cork-cellulose materials may give top performance. The most popular type for operation in oil is a composite consisting of a dual-faced assembly with alternately opposed nesting rings of cork and cellulose. The friction properties are at the top of the range. The engagement characteristics are good. And the natural dampening characteristics tend to prevent chatter.

Cork and cellulose materials, however, char to destruction at temperatures close to 400°F. Where higher heat resistance is required, R/M semi-metallic friction materials are widely used. Their durability is much greater than that of resilient types, their engagement characteristics are comparable, but their friction range is lower.

There is some drop-off in friction during the life of semimetallic materials, but stability of friction under relatively severe operating conditions is one of their recognized advantages. Their versatility is important, too, for they can be made in thin, conformable sections readily adaptable to such uses as bands, plates, cones and intricate shapes.

Woven and molded asbestos, sintered metal, corkcellulose, and semi-metallic are but five types in the complete R/M line covering all kinds of friction material. Thus, whatever your friction requirements may be—whatever the application—Raybestos-Manhattan is in a unique position to supply the exact friction parts for your purpose.

Remember—next time you have a friction problem—that R/M alone works with *all* friction materials. And remember that all the depth and breadth of R/M experience—the complete facilities of R/M's seven

great plants with their research and testing laboratories—are as near as your telephone to help you solve it.

Write for your free copy of R/M Bulletin No. 500. Its 44 pages are loaded with practical design and engineering data on all R/M friction materials,



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FRICTION MATERIAL DEVELOPMENT

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RAYBESTOS-MANHATTAN, INC., Brake Linings • Brake Blocks • Clutch Facings • Fan Beits • Radiator Hose • Industrial Rubber, Engineered Plastic & Sintered Metal Products • Rubber Covered Equipment • Asbestos Textiles • Laundry Pads & Covers • Packings • Abrasive & Diamond Wheels • Bowling Balls

On materials handling machines used by





modern farmers ... by the armed forces ...





and by all branches of industry ...



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On all kinds of materials handling equipment, dependable Blood Brothers Universals have won "first choice" reputations. This success results in part from close cooperation between our engineers and the men who design the machines . . . with the mutual goal of superior performance for the end user.

When you have a power transmission problem - large or small - contact Blood Brothers' engineers for suggestions. They'll gladly work with you . . . just write or call.





BLOOD BROTHERS MACHINE DIVISION

ROCKWELL SPRING AND AXLE COMPANY ALLEGAN, MICHIGAN

UNIVERSAL JOINTS AND DRIVE LINE ASSEMBLIES

USS GERRARD ties anything you've ever seen



Allis-Chalmers Manufacturing Company, Tractor Works, West Allis, Wis., reinforces packages of all sizes quickly, securely, and inexpensively with USS GERRARD ROUND STEEL STRAPPING

When Allis-Chalmers West Allis, Wis., Tractor Works began packaging replacement parts in cartons to improve its shipping operation, USS Gerrard Round Steel Strapping was chosen as reinforcement. As a result, it provides a neat, inexpensive way to close cartons quickly, protects the product, saves the carton for re-use, and displays the advertising on the

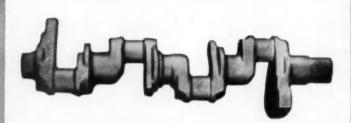
box continuously.

Allis-Chalmers is using USS Gerrard Round Steel Strapping to secure packages which vary from 4-inch-square boxes, weighing less than a pound, to huge 38" x 30" x 34½" cartons which weigh up to 3,000 pounds. Even complete tractors are disassembled and crated for export to reduce cubage charges. They, too,

are reinforced with USS Gerrard Round Steel Strapping.

Take a tip from a highly successful organization, and try USS Gerrard Steel Strapping — Round or Flat. Whatever your packaging-tying problem might be, our engineers can help you find the safest, most economical solution. Contact us now.

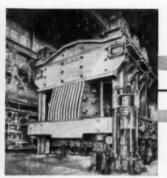
whether you think in terms of



The crankshaft is the backbone of the pistontype engine. Illustrated above is the crankshaft forging for the most powerful piston-type aircraft engine ever produced.

Horsepower

or



Thrust

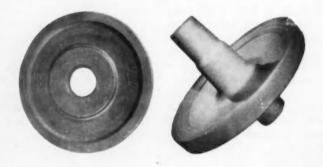
The history of Wyman-Gordon's contribution to aircraft progress dates from the inception of the "flying machine".

The jet age is now calling on the unparalleled resources of Wyman-Gordon, which include the widest range of hammer and press equipment and the greatest technical know-how in the industry.

Larger and more intricate forgings than heretofore available of aluminum and magnesium are being produced on presses up to 50,000 ton capacity, and giant hammers are fulfilling the growing need for forgings of titanium, high density materials or so-called super alloys.

Now, as for nearly 75 years, there is no substitute for Wyman-Gordon experience and ability for — Keeping Ahead of Progress.

At the bottom left is a turbine disc forging made from high density heat resisting alloy, and next to it is a titanium compressor wheel forging for two of the most powerful jet engines yet produced.



WYMAN-GORDON COMPANY

Established 1883

FORGINGS OF ALUMINUM . MAGNESIUM . STEEL . TITANIUM

WORCESTER 1, MASSACHUSETTS

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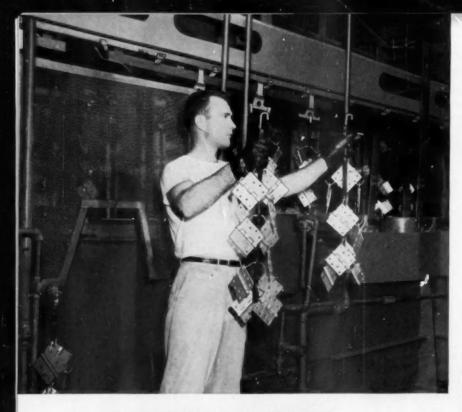


Genuine leather upholstery is a proud banner for many of your customers.

It gives them a feeling of success. Its atmosphere of quality
adds to the appeal of the cars you sell. And it gives
you a means of trading-up. You can say, "That's a fine model
... but this one is upholstered in genuine leather!"

Only genuine leather wears as well as it looks

THE UPHOLSTERY LEATHER GROUP, INC. • 99 West Bethune, Detroit 2, Mich. • 141 E. 44th Street, New York 17, N.Y.



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Each day, over twenty thousand door hinges are cadmium, copper and brass plated by three Udylite automatic machines owned by C. Hager & Sons Hinge Manufacturing Company, St. Louis, Missouri. Cadmium plating is for protection from rust and corrosion—the copper and brass plating for a gleaming, luxurious finish.

The Hager Company installed these machines five years ago when it was decided to eliminate their hand operations. Production has increased one hundred fifty percent with the Udylite Automatics—the finishes are more uniform—the rejects reduced to practically nil, and as with most Udylite machines, there is very little maintenance.

Have you checked your metal finishing operations lately? If you do plating, anodizing, blackening, or other types of metal finishing in volume, you should investigate the Udylite automatic equipment and Udylite finishing processes. They are known the world over.



WORLD'S LARGEST PLATING SUPPLIER

ASME Petroleum-Mechanical Engi-Conference, Conrad neering Hilton Hotel, Dallas Tex... Sept. 23-26

Trade Fair of the Atomic Industry, Navy Pier, Chicago, Ill.... Sept. 24-28 Atomic Industrial Conference

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Paris Automobile Show, France. Oct. 4-14 ASME - ASLE Third Lubrication Chalfonte-Haddon Conference, Hall, Atlantic City, N. J....Oct. 8-10

National Metal Exposition, Pub-lic Auditorium, Cleveland, O. Oct. 8-12

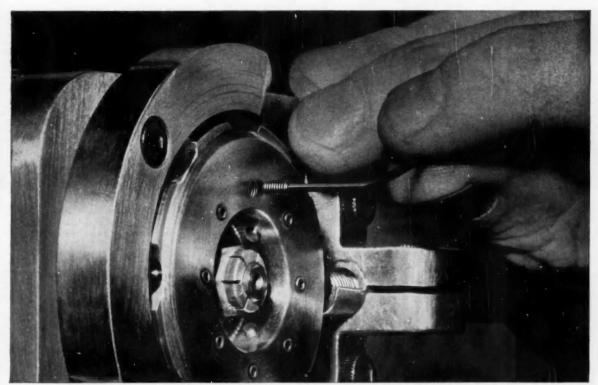
SAE National Transportation Meeting, Hotel New Yorker, New York, N. Y. Oct. 10-12

American Society of Body Engineers, annual convention, Rack-ham Bldg., Detroit, Mich...Oct. 17-19

rnational Motor Show, Earls Court, London, England . . Oct. 17-27 International Motor National Conference on Industrial Hydraulics, Sherman Hotel, Chicago, Ill. Oct. 18-19

SIPMHE Protective Packaging and Materials Handling Exposition, Kiel Auditorium, St. Louis, Mo. Oct. 21-24

National Industrial Exposition Management Conferences, tillery Armory, Detroit, Mich. Oct. 22-26



Microsize UNBRAKO socket screws simplify design problems—even in highly specialized equipment like this prototype precision loading device for use in advanced automated production operations.

Miniaturize with UNBRAKO set screws

HEAT-TREATED ALLOY STEEL* PLAIN CUP POINT

Class 3 Fit Standard

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#1	D .073 F .035		72 72 72 72 72 72 72	1/16 3/32 3/6 6/32 3/16 3/4	**	1.5 1.5 1.5 1.5 1.5	.02 .02 .02 .02 .02 .02	
*2	D .086 F .035	56 56 56 56 56 56	**	1/16 1/22 1/6 1/32 1/16 1/4	1.5 1.5 1.5 1.5 1.5 1.5	**	.03 .03 .03 .03 .03	
#3	D .099 F .050	48 48 48 48 48	**	3/52 1/6 9/52 3/16 1/4	5.0 5.0 5.0 5.0 5.0	**	.04 .04 .04 .04	

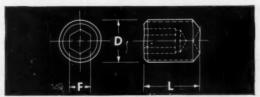


You need not design special set screws to secure your new miniaturized equipment. Microsize UNBRAKOS were developed specifically for use in modern small devices.

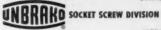
UNBRAKO screws are made of carefully selected alloy steel. They are manufactured to timepiece precision. Sockets are deep and

uniform for greatest wrench engagement and longest reuse. Threads are fully formed for maximum strength and exact fit. And UNBRAKOS are heat treated to the optimum condition for high tensile strength and ductility without brittleness or decarburization.

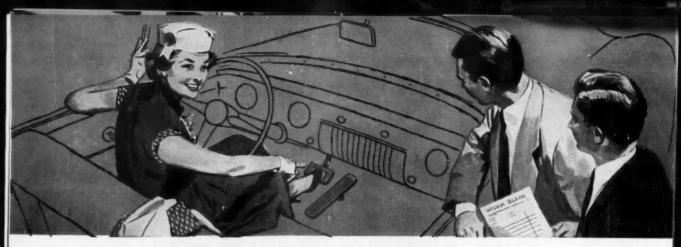
Ask your authorized industrial distributor about microsize Unbrako socket screws today. Or write us for Bulletin 2055 and samples. Unbrako Socket Screw Division, STANDARD PRESSED STEEL Co., Jenkintown 53, Pa.



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This industry-wide acceptance of the most revolutionary development in braking since Bendix four-wheel brakes is convincing evidence of Bendix foresight in research and engineering. And the fact that today more Bendix Power Brakes are in use than all other makes combined demonstrates con-

Brakes are a potent source of customer good will from the

first mile to trade-in time.

ahead for the industry's requirements.

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RUSSELL W. CASE, JR.

High Spots of This Issue

★ Development of Expanded Resins for Aircraft Usage

Traditionally used in applications where conventional materials were not practical, expanded resins are constantly enlarging their scope in the aircraft field. Presented here is a review of current and potential uses. Page 48.

★ V-8 Truck Engine Production at International Harvester

Faced with the problem of attaining a moderate-volume, yet highly-efficient, output of its new truck engines, IHC went about finding a solution in ingenious ways. The author relates how this difficult goal was reached. See Page 52.

★ Major Engine Projects Unveiled at SAE Summer Meeting

The 1450 conferees on hand in Atlantic City last month for the SAE Summer Meeting were kept well-occupied with a host of technical sessions. Particular interest was centered on those dealing with new engine developments. Page 56.

★ Fuller's Expanded Facilities for Transmission Output

In order to meet a feverish demand for its versatile heavy-duty transmissions, Fuller Manufacturing Co. has grown tremendously. Here is the story of its phenomenal expansion and the wealth of new facilities that were involved. Page 66.

★ 1956 Material Handling Exposition

Sparkling with color and crowded with throngs of visitors, the recent Material Handling Show was an overwhelming success. This on-the-spot report highlights the exhibits and other activities for those who couldn't be there. Page 70.

★ 33 New Product Items And Other High Spots, Such As:

Detroit's first annual conference on tooling and materials; many automotive subjects discussed at ASQC convention; special crane for chassis frames; 40th annual meeting of AGMA; and Vickers' machine tool hydraulic forum.

Complete Table of Contents, Page 3
Automotive and Aviation News, Page 33

A Head for Low-Cost Production

Duplex Head on Cincinnati 0-8 Plain Rise and Fall Mills an Extra Surface

This machine has a head for business. It's a CINCINNATI® No. 0-8 Plain Rise and Fall Milling Machine, equipped with a duplex head to mill both sides of small parts in one cycle, and one handling of the work.

Production averages 223 parts per hour, about double what it would be without the Duplex Head. The drawing below indicates surfaces milled.

This equipment is the work of Cincinnati Application Engineers, a group of specialists who help metalworking industry reduce the cost of doing business. You can enlist their aid by sending blueprints and complete data on the parts which you suspect of being high-cost components. Meanwhile, you might like to know more about the highly productive 0-8 Milling Machines. Look in Sweet's Machine Tool File, or write for catalog No. M-1607-2.

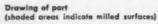
THE CINCINNATI MILLING MACHINE CO. CINCINNATI 9, OHIO





No. M-1607-2.





Part name rear sight base Material steel forging Operation mill two sides Production 223 per hour

CINCINNAT

MILLING MACHINES - CUTTER SHARPENING MACHINES - BROACHING MACHINES - METAL FORMING MACHINES - FLAME HARDENING MACHINES OPTICAL PROJECTION PROFILE GRINDERS - CUTTING FLUID

Lews of the AUTOMOTIVE AND AVIATION INDUSTRIES

Vol. 115, No. 1

July 1, 1956

Ford Steps Up Research On Free Piston Engines

Current interest in gas turbine and free piston engines for automobiles is prompting car manufacturers to step up development work on such engines. Almost simultaneous with the announcement that it is experimenting with a free piston engine, Ford said it plans to expand its laboratory facilities for testing gas turbine and free piston power plants.

The company will construct a 70,000 sq ft propulsion laboratory adjacent to its Research and Engineering Center in Dearborn, Mich., which will replace a small pilot facility built several years ago. Representing one of the major units at the Center, the laboratory will include 12 main cells and at least 10 dynamometers for testing engine components and performance.

Individual cells will receive fuel from underground tanks located outside of the building. Floors of the building will be covered with sparkproof material, and a huge ventilation system will withdraw 41,000 cuft of air per minute from each cell to keep it free of exhaust fumes. Work on the laboratory is scheduled to start in 1957 with completion planned about a year later.

AMC To Drop Nash, Hudson Nameplates From Rambier

American Motors will put the Rambler on its own beginning with 1957 models by dropping any designation as a Hudson or Nash Rambler. The Nash and Hudson name plates next year will be confined only to the larger cars in the company's line.

Currently 65 per cent of the company's volume is in Ramblers. In preparation for the move, the field organization is being reorganized. All zones will be under an AMC zone



LIGHTWEIGHT PLASTIC CAR RIDES ON THREE WHEELS

Reinforced plastic body of the new 400-lb Star utility car is molded over a frame of welded tubular steel. Built by Bassons Industries Corp. on a three-wheel chassis, the vehicle is powered by a German J.L.O. one-cylinder, two-stroke, 10-hp, aircooled engine. Steering gear ratio is said to be 2:1 for high degree of maneuverability.

manager, and all but the four smallest zones will have separate sales managers for Hudson and Nash. Objective for the Rambler is six per cent of the low-priced market.

S-P Obtains Two Orders For J-57 Engine Tooling

Recent Air Force contracts awarded to Studebaker-Packard Corp. will have little immediate effect on the company's work force in the Detroit plant, where most military work has been confined. The contracts are relatively small, since one totals \$1.42 million and another slightly under that amount, and they are not for actual production.

The money awarded under both contracts will be used by S-P for installation of new tools and machinery for production of J-57 aircraft parts at the East Grand Blvd. plant in Detroit. How soon an actual production contract will be forthcoming is not known. The corporation is producing some J-57 parts now.

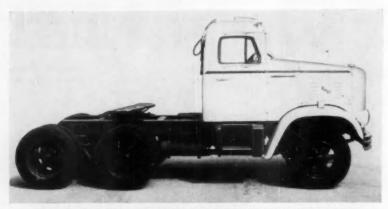
Car Sales For First Half Destined For Near Record

The automobile industry enters the third quarter of 1956 in a much better position than it has been for several months. An upturn in retail sales, which began to appear in the latter part of May and which continued into June, plus adjustments in production in the past several months, are helping to reduce record inventories at a substantial rate.

Although sales results for June are incomplete, all signs point toward the second best January-June period on record, with estimates ranging in the neighborhood of 3.1 million or more units. This would be topped only by the first six months of 1955, when sales reached 3.5 million cars.

Despite sharp production cutbacks by nearly every car maker, output for the first six months is expected to reach 3.2 million units. It would thus be the third best January- June period on record, surpassed only by 4.2 million cars in the first half of last year and 3.25 million in 1953.

Thews of the AUTOMOTIVE



LIGHT TRANSPORT TRACTOR FOR HEAVY-DUTY WORK

Lightweight transport tractor Model T-646, recently announced by Four-Wheel Drive Auto Co., is powered by a 182-hp RD-450 gasoline engine with a Fuller Model 5A-62 transmission that has five forward speeds and one reverse. Weight saving is accomplished in the 9730-lb transporter by means of such features as aluminum construction of fuel tanks, front bumper, and rear bagie saddle and walking beam assembly.

Oldsmobile Notes Step-Up In Air Conditioner Sales

While sales of air conditioners on the lowest-priced automobiles do not yet account for more than one per cent of total car production, the number of units installed on higher-priced cars has made marked gains this year. Oldsmobile reports that the number of units installed by its dealers in the eight months ended in May increased by 100 per cent above the comparable time a year earlier.

Factory installations of the units in the same period totaled 18,470, compared with 12,212 in the eight-month period ended May 1955, a 50 per cent increase. Oldsmobile estimates that about six per cent of all the cars it built in that period were equipped with air conditioners, compared with 3.7 per cent a year ago.

Proposal to Cut Car Prices Deemed Out of the Question

Walter Reuther's recent proposal that car manufacturers reduce prices during slack periods is another of numerous suggestions being advanced presently which offer no immediate solution to any problems faced by the industry. Like many other ideas presented in recent weeks in an attempt

to solve the unemployment problem, Reuther's proposal involves a number of complications which make the plan questionable.

Even if car companies decided to cut prices simultaneously, they would face the risk of violating anti-trust laws. Since smaller companies, such as American Motors and Studebaker-Packard, could not possibly trim prices, their sales would be hurt even more since they could not compete with the larger companies. Dominance of the larger companies would become even greater with the result that the smaller concerns could be forced out of business.

Cutting prices during a particular season of the year admittedly would boost sales and lower unemployment. However, the market probably would become so oversold during the period of lower prices that sales would drop off in subsequent months, and production again would have to be reduced.

Technically, car prices are being cut at present by dealers in an effort to move out huge inventories. Many dealers are offering substantial discounts, and they are not realizing their traditional maximum 24 or 25 per cent markup suggested by the factory. Higher steel prices, almost certain to come, further rule out any price cuts by factories at this time.

White and Reo Anticipate Higher Sales During 1956

From all indications, 1956 should be a very good year for the truck manufacturing industry. Unlike car sales, volume by truck makers has been picking up substantially, and several companies expect their sales this year to exceed those of 1955. Sales of heavy-duty trucks in particular have been rising steadily and are expected to be sustained for some time.

High optimism is expressed by at least two manufacturers of heavyduty units—Reo Motors Inc. and White Motor Co. Reo's dollar volume in the first five months of this year has been far ahead of last year, and the company reports the largest backlog of commercial orders since 1948. Unit sales are running about eight per cent ahead of last year with the bulk in heavy-duty models of 26,000 GVW and over.

Further illustrating the growth of the heavy-duty market is a report from White which shows that such models accounted for more than 11 per cent of the total of all types of trucks registered during the first quarter. This figure compares with 8.5 per cent in the same three months last year.

White looks forward to sales in excess of \$200 million this year, which would be an impressive gain over last year's record of \$179.9 million. Earnings are expected to total approximately \$6.5 million, against an all-time high of \$6 million last year.

Present AMA Officers Elected To Additional One-Year Terms

The Automobile Manufacturers Association last month (June) re-elected its entire slate of officers for another one-year term. Re-elected were: James J. Nance, head of Studebaker-Packard Corp., president; E. J. Bush, president of Diamond T Motor Car Co., vice-president; Harlow H. Curtice, president of General Motors Corp., secretary; George W. Romney, president of American Motors Corp., treasurer; Alfred Reeves, advisory vice-president, and William J. Cronin, managing director.

AND AVIATION INDUSTRIES

GM and Ford Only Two Makers To Hike Shares of Car Output

General Motors Corp. and Ford Motor Co. are the only two car producers which have captured a larger share of the industry's automobile production this year than in 1955. GM's share. however, has declined slightly in the last few weeks, while Ford has made moderate gains.

Through May 1, GM held 55 per cent of the industry's total production of automobiles, but estimates in mid-June showed that it had declined to 54.4 per cent. However, the total was still substantially ahead of the 49.1 per cent GM held last year at this time.

Ford, on the other hand, has gained about one per cent in the industry's penetration in six weeks in climbing from 26 per cent on May 1 to 27 per cent in mid-June. This was slightly ahead of the same time last year, when Ford's share totaled 26.7 per cent.

Chrysler's share of total production has been holding steady this year, remaining unchanged at 14.6 per cent from May 1 to mid-June. It was down markedly, however, from approximately 19 per cent last year.

Both American Motors and Studebaker-Packard lost ground last month. AMC's share dropped from 2.1 per cent on May 1 to 1.9 per cent in mid-June, while S-P declined from 2.06 per cent to 1.9 per cent.

Retarders For Truck Axles May Require Further Study

Axle manufacturers indicate that they would have to make a thorough analysis before approving use of retarders with their present truck axles. They point out that gearing now provides for adequate strength on the drive side, but is not designed to take the much heavier strain imposed by retarders on the coast side.

Actual force exerted by the retarder may be two or three times that put through the drive gearing by the engine. It may require axle modifications involving increased size of gearing, altered disposition of bearings, or perhaps a new design.

NEW CUMMINS TURBODIESEL

Shown here is the latest addition to the Cummins family of Turbodiesel engines. The NRTO-6 has a displacement of 743 cu in and develops 335 hhp at 2100 rpm with a 90 F intake air temperature from zero to 4000 ft. High output is made possible by a new exhaust gas turbocharger.



Car Distribution System Threatened by Two Bills

The testimony presented last month by the Big Three car companies, in answer to a bill designed to outlaw many present automobile marketing practices, represents the most objective and intelligent approach undertaken since the industry started coming under attack by automobile dealers. The ultimate effects that the Monroney bill would have on not only factory-dealer relations, but on the entire economy were cited in detailed statements by representatives of the three automobile companies.

The bill, representing demands of the National Automobile Dealers Association, is now being considered by a Senate Commerce subcommittee. If enacted, the measure would (among other things) give the Federal Trade Commission the power to prohibit car makers from forcing unwanted cars on dealers, give dealers the right to return unsold cars to the factories, and place limits on the freedom of factories to cancel dealer franchises.

If the measure is passed, it would give rise to a morass of regulations, litigations, and strife. It would impose restrictions on automotive manufacturers of a kind not imposed on any other manufacturing industry. Legality of every aspect of the bill would

probably be tested, both before the Federal Trade Commission and in courts.

While they did not specifically say so, the car companies implied that they probably would revise the entire present distribution system to the point where the dealer franchise system might even be abandoned. The bill, as it stands now, would subject the automotive-dealer relationship to close and detailed supervisory regulation by the Federal Trade Commission, which probably would include contract making, product pricing, etc.

The ultimate result of the bill would be that it would impede the industry's selling efforts, according to industry testimony. It would decrease sales, reduce volume of production, raise costs and increase prices.

Meanwhile, another bill previously introduced by Sen. O'Mahoney came under sharp criticism by the Justice Dept., which has been opposing legislation regulating automobile industry practices. The bill, which the Justice Department charged was approved by the Senate Judiciary Committee without holding any hearings on it, would, among other things, give car dealers the right to sue the car manufacturer if the latter didn't act in

Trews of the AUTOMOTIVE

"good faith" in carrying out franchised contracts.

Just at presstime, it was disclosed that the Senate had passed a toned-down version of the O'Mahoney bill. While guaranteeing dealers the right to sue car makers, it gives the automobile manufacturers certain safeguards not contained in the original bill.

One amendment would require the car dealer also to act in "good faith"

in carrying out his franchise contract. A second amendment would let the producer use as a defense, in a suit brought by a dealer, the latter's alleged failure to act in "good faith."

Finally, instead of allowing the dealer to collect double damages in a successful suit, the revised bill only allows the dealer to collect for damages actually sustained. The bill now goes to the House of Representatives.

Four-Wheel Drive Offered On GMC Light-Duty Models

GMC Truck & Coach Div. of General Motors Corp. is now offering six basic models of its truck line. Included are pickups, panels, suburban station wagons and stake trucks in the half through one-ton weight range.

They are available with 130-hp, 270-cu in., six-cylinder gasoline engines or 180-hp, 316-cu in. V-8's, and either four-speed manual or Hydra-Matic transmissions.

The four-wheel-drive shift lever, separate from the conventional gear shift, has both a high and a low position. The low is for worst possible driving conditions; the high is for regular cross-country travel.

Regular gear shifting is used with both high and low four-wheel-drive settings to give the trucks four forward speeds in each range and a total of eight forward speeds in four-wheel drive. In vehicles with Hydra-Matic transmissions, the up and downshifts are automatic in each four-wheel-drive setting.

1956 WEEKLY U. S. MOTOR VEHICLE PRODUCTION As reported by The Automobile Manufacturers Association

	June 16	June 9	June 2	May 26	Jan. 1 through June 16, 195
PA	SSENGER	CAR PRO	DUCTION		
Hudson	416	0	395	606	17.650
Nash	1,149	Ö	971	1,086	40,747
Total American Motors	1,565	0	1,366	1,692	58,397
Chrysler and Imperial	2,080	2.662	1.085	2,665	60,330
De Sote	1,987	2.087	874	1,591	53,276
Dodge	4,193	4,256	3.702	4,484	100,129
Plymouth	4,472	7,546	3,971	8,611	227,242
Total-Chrysler Corp	12,602	16,551	9,632	17,351	440,977
Fard	24,439	24.937	19.920	24.482	649.792
Lincoln and Continental	800	806	337	957	26,742
Mercury	5,195	5,304	670	6,197	128,696
Total-Ford Motor Company	30,434	31,047	20,927	31,636	805,230
Bulck	9.534	9.555	7.619	9,604	305,425
Cadillac	3.184	3.193	2.860	3.387	78,611
Chevrolet	28,673	29.955	24,607	29.272	819,250
Oldamobile	7.668	7,460	5.970	7.647	237,482
Pontiac	5,406	5,480	4,409	5,656	180.657
Total—General Motors Corp	54,465	55,643	45,265	55,568	1,621,435
Packard	494	505	262	480	12,591
Studebaker	962	1,250	346	1,397	45,262
Total Studebaker-Packard Corp.	1,456	1,755	808	1.877	57,853
Checker Cab	113	90	34	112	1,466
Total—Passenger Cars	100,725	105,086	77,832	108,236	2,985,358
	TRUCK	PRODUCT	ION		
lvailable	9	7	7	7	194
hevrolet	6,901	6.756	5,649	6,322	183,724
3. M. C.	1.626	1,849	1,507	2,212	48,206
Diamond T		102	78	102	2,239
Divce	74	80	64	80	2,019°
lodge and Farge	1,533	1,905	1,617	1,848	42,127
	5,575	6,160	4,832	5,790	148,725
. W. D	2.331	2.707	2,117	2,739	901*
	290	252	328	453	88,582 8,788
		17	8	3	210
			62	79	1.777
Aarmon-Herrington	19	90			
Aarmon-Herrington leo Itudebaker	79 311	334	98	333	7.423
Aarmon-Herrington leo Itudebaker Yhite	79 311 379	334 387	98 237	333 383	7.423 9.105
flarmon-Herrington lee tudebaker Viltys	79 311 379 1,304	334 387 671	98 237 581	333 383 1,295	7,423 9,105 28,356
Aarmen-Herrington lee itudebaker Vhite Villya Uther Trucks	79 311 379 1,304 219	334 387 671 106	96 237 581 93	333 383 1,295 128	7,423 9,105 28,358 2,719
Aarmon-Herrington lee tudebaker Viite Viitys	79 311 379 1,304	334 387 671	98 237 581	333 383 1,295	7,423 9,105 28,356

Third Parts Warehouse Planned By Chevrolet

Chevrolet is moving ahead rapidly with its program designed to expand parts warehousing facilities around the country. Newest unit to be added to the division's network of parts facilities is an 82,000 sq ft combination zone office and warehouse building at Cleveland.

The warehouse, which will be used to stock parts and accessories for Chevrolet, Oldsmobile and Pontiac dealers, is the third to be announced by Chevrolet since March. Two other facilities are now under construction in Cincinnati and St. Louis.

Studebaker Offers Overdrive Unit On One-Ton V-8 Trucks

Studebaker is first in the industry to offer an overdrive transmission on one-ton V-8 engine trucks. The overdrive had been offered through the light and medium duty V-8 truck lines. The one-ton units are equipped with five-speed overdrive transmission using a .798 to 1 gear ratio.

*-- Through June 9 only.

AND AVIATION INDUSTRIES



BIG METAL POWDER PRESS

This 300-ton hydraulic press is now in operation at U. S. Graphite Co. Said to be the first of its size ever used to compact parts from metal powders, it was designed and built by Baldwin-Lima-Hamilton Carp.

Car Painting by Radiation Gun Is Visualized by Ford Official

Looking into his crystal ball at the recent Ford Engineering Forum, executive vice-president Del S. Harder, foresaw the day when an electro-magnetic radiation gun will be used to paint cars. If and when such a technique comes to pass, cars shipped from the factory would presumably be painted with photo-sensitive pigments of a neutral shade. The dealer could conceivably then use such a radiation gun to bring about any color a buyer might want.

Other possible developments were outlined for some 50 engineering educators present. Among them were: molten steel taken directly from the furnace and cast continuously through water-cooled copper molds into semifinished slabs; control of machine tools by magnetic tape; all-aluminum radiators in the near future.

S-P. Curtiss-Wright Situation

At press time, AUTOMOTIVE INDUSTRIES received this authoritative word from an informed source that cannot be revealed. If a proper mutual ground can be found that will strengthen both Studebaker-Packard Corp., and Curtiss-Wright Corp., an alliance or affiliation will be in order and, in all likelihood, will be consumated.

TABLOID

Perfect Circle Corp. has purchased Corona Oil Specialties & Service Co. of La Canada, Calif.

Le Roi Div. of Westinghouse Air Brake Co. is currently celebrating its 40th anniversary.

Wagner Electric Corp. has consolidated all of its automotive and electrical engineering and research facilities.

General Electric Co. will build a \$4 million communications equipment plant near Gainesville, Fla. ... Caterpillar Tractor Co. has announced formation of a new parts depot near Miami, Fla.

Ryan Aeronautical Co. is developing a new vertical takeoff plane for the Army that will be powered by a single gas turbine engine driving two propellers.

. . .

American Iron and Steel Institute has moved to 150 East Forty-Second St., New York 17, N. Y.

. . .

Mack Trucks, Inc. has merged several of its wholly-owned subsidiary companies under the parent name.

Heil Co. has developed a onepiece molded plastic body for refrigerator trucks. . . . Highway Trailer Co. is testing a new light plastic trailer.

Studebaker has opened a new service research center at South Bend, Ind.

Texas Instruments, Inc., has acquired Wm. I. Mann Co. . . . Youngstown Manufacturing, Inc., has acquired the facilities of Ford Moulding Co.

Douglas Aircraft Co. will erect a new missiles production plant at Sacramento, Calif.

Curtiss-Wright Corp. plans to set up a new nuclear materials laboratory at Quehanna, Pa.

Ford Div. of Ford Motor Co. has stepped up its car production schedule eight per cent over that for June due to rising demand.

Kaman Aircraft Corp. is now making its K-600 helicopter available to non-military users.

. . .

North American Aviation, Inc., is doing research and development on a manned aircraft (the X-15) for investigation of high altitudes, speeds, and temperatures.

Russia is claimed to have produced an experimental jet-propelled automobile with speeds up to 200 mph.

Ramo-Wooldridge Corp., will start working on its new \$5.5 million Denver, Col., plant some time this month.

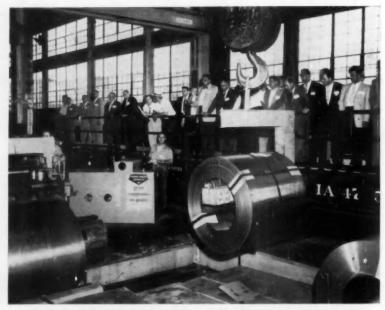
American Steel & Wire Div. of U. S. Steel Corp. has established a fatigue testing laboratory at its Cuyahoga Works in Cleveland, O.

Allegheny Ludlum Steel Corp. and Midvale-Heppenstall Co. have completed an agreement for the sale by the former of technical knowledge and patent rights for the production of consumable electrode vacuum remelting of steel and ferrous group base alloys.

Ryan Aeronautical Co. will build a new high-altitude version of its Firebee jet drome missile.

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Thews of the AUTOMOTIVE



RYERSON PLAYS HOST TO CHICAGO PLANT VISITORS

Sheet steel in coils weighing up to 15 tons is slit and cut to length, as visitors look on during a recent three-day "Open House" at the Chicago plant of Joseph T. Ryerson & Son, Inc. The event, attended by some 16,000 customers, suppliers, employes, and others, included a two-hour tour of the facilities in the plant.

Gemmer, Ross Postpone Stockholders Meeting

The meeting of shareholders to vote on a proposed plan to merge Ross Gear and Tool Co. Inc., and Gemmer Manufacturing Co., originally scheduled for July 2, has been postponed to about July 16.

1956 RETAIL CAR SALES BY PRICE GROUPS*

Number of Cars

		Apri)		Four Months				
	1956		1955		1958		1955		
Price Group Under \$2,000	Units† 107,054 310,121 116,422 22,941	% of Total 19.24 55.72 20.92 4.12	Units† 350,397 203,948 78,056 18,475	% of Total 54.09 31.48 11.58 2.85	Units† 386,084 1,093,977 421,700 82,231	% of Total 18.64 55.70 21.47 4.19	Units† 1,171,844 689,338 263,621 66,978	% of Total 53.46 31.45 12.03 3.06	
Total	556,538	100.00	647,876	100.00	1,964,011	100.00	2,191,781	100.00	

Dollar Volume of Sales

			Apr	riii			Four Months				
	1956		1955		1956		1955				
Price Group Under \$2,000 \$2,001 to \$2,500 \$2,501 to \$3,500 Over \$3,500	8	Dellars 210,073,813 671,801,551 323,466,884 98,340,182 ,304,482,430	% of Total 16.10 51.48 24.80 7.62	\$	Dellars 044,785,941 476,700,344 212,915,332 75,103,583	% of Total 46.51 33.35 14.89 5.25	Dollare \$ 714,261,258 2,359,032,419 1,173,784,147 350,188,323 \$4,597,296,147	% of Total 15.54 51.31 25.53 7.62	Dollars \$2,225,678,475 1,606,612,270 749,370,528 273,369,218 \$4,857,030,491	% of Total 45.82 33.12 15.43 5.63	

*—Calculated on basis of new car registrations, as reported by R. L. Polk & Co., in conjunction with advertised delivered price at factory of four door sectan or equivalent model. Does not include transportation charges or extra equipment.
†—New registrations of American made care only. Does not include imported foreign care.

Usage of Anodized Aluminum Parts in Cars Surges Ahead

Applications of anodized aluminum for decorative purposes are increasing steadily, according to a survey conducted by F. B. Stevens, Inc., producers of plating equipment. This development is in line with the general trend toward greater use of aluminum for decorative purposes, regardless of the type of exterior finish employed. An article by R. E. Conlee of Alcoa entitled "Still More Aluminum Used in Cars for 1956" (see AI, Jan. 15, 1956) exemplified this point.

The results of the Stevens survey, which covers specific parts produced with an anodized finish, are summarized in the table below. The actual number of 1956 cars in which they are used is given in the center column, while the right-hand column shows an estimated number of 1957 cars in which specific anodized aluminum components will be used:

Application	1956 Cars	1957 Cars
Scuff Plates	1	1 or more
Window Frames	3	6 or more
Instrument Pane		
Overlays	2	2 or more
Grilles	4	6 to 8
Emblems (V, Se		
Block)	4	8
Seal Trim	2	2 or more
Moldings	3	S to 9

Chevrolet Builds Million Vehicles In 51/2 Months

Chevrolet on June 15 turned out its millionth vehicle of the 1956 calendar year, only nine days behind the same number of vehicles built in 1955. Trucks contributed importantly to the near-record volume in accounting for more than 22 per cent of Chevrolet's total production. The million vehicles included 821,043 cars and 184,319 trucks.

Correction

In the article "Epoxy Resin Finish Protects Truck Rims," which was published in the June 1, 1956 issue of AUTOMOTIVE INDUSTRIES, the caption with the photograph at the top of page 64 should have read as follows:

"Start of a paint shop cycle: steel rims being transferred to the monorail conveyor for transport through the R. C. Mahon unit at the right for Oakite CrysCoat surface treatment."

AUTOMOTIVE INDUSTRIES, July 1, 1956

AND AVIATION INDUSTRIES

AC To Expand Electronics Operation By 25 Per Cent

AC Spark Plug Div. will expand its floor space in Wisconsin by nearly 25 per cent with the addition of a new 225,000 sq ft plant for production of electronic equipment for defense. The new plant, to be built in the Milwaukee suburb of Oak Creek, is scheduled for completion this year.

The division currently is working on about \$90 million in defense orders, basically for electronic bombing systems and sights. It recently received a substantial contract for the development of a system which would guide missiles to their targets.

In addition, the division announced last month that it had received another contract for production of spark plugs for aircraft. Work on that order, valued at \$627,555, will be done at Flint, Mich., where all aircraft spark plug operations are confined.

Novel Tubular Axle Offered On Specific Fruehauf Models

Fruehauf is adopting a new tubular axle of its own design on air suspension trailers and certain special models. It has the same spindles, wheel bearings and brakes as the conventional I-beam axle, and was designed especially for air suspensions because torque is transmitted through the axle beam.

An additional reported manufacturing economy advantage is the fact that it is better suited for special tread jobs, such as car haulaways, because length can be varied merely by using a longer or shorter tube.

GM Dealer Bucks Sales Drop With Increased Advertising

Providing quite a contrast to the somber comments on current automobile sales by many dealers throughout the length and breadth of the U. S., one of the largest General Motors dealers in the country has reported that his sales for the first five months of 1956 were up \$4 million over the same period a year ago. R. E. Dumas Milner, operator of four Chevrolet and two Pontiac agencies in the South and Southwest, attributes much

APRIL UPTURN IS WELCOME HARBINGER OF SPRING 1956 New Passenger Car Registrations*

Arranged by Makes in Descending Order According to the 1956 Four Months' Totals

				FOUR MONTHS				
MAKE				-	Units		Per Cent of Total	
	April 1956	March 1956	April 1955	1956	1955	1956	1955	
Chevrolet	146.515	138,094	139,527	508,618	443,798	25.57	20.34	
ord	123,940	118,309	138,502	421,923	463,949	21.21	21.28	
luick	53.027	53,982	71.127	197,364	240,628	9.92	11.04	
lymouth	45,977	48,190	63,538	167,453	217,651	8.42	9.98	
Idamobile	42.533	41.825	53.285	156.571	183,264	7.87	8.41	
ontiac	34,952	35,364	48,589	127.637	167,057	6.42	7.66	
Tercury	26,843	25.485	32,834	92,164	107,900	4.63	4.95	
odge	20.585	19,749	28,174	71,942	94,522	3.62	4.34	
adillac	13,489	12,568	13,072	47,837	49,426	2.41	2.27	
hrysler	11,806	11.244	15,311	41,021	55,431	2.06	2.54	
e Soto	9.927	9.788	11.784	34,815	40,412	1.75	1.85	
tudebaker	8.137	8,200	10,017	30,737	34,126	1.55	1.57	
ash	8,007	7,829	9,793	27,478	26,551	1.38	1.22	
incoln	4.087	3,679	2,758	13,877	9,248	.70	.42	
ludson	3,202	3,400	5,066	11,833	13,991	.60	.64	
ackard	3,121	2,959	5,738	11,646	15,923	.50	.73	
ontinental.	150	175		700	STREET,	.04		
fisc. Domestic	407	291	938	926	3,884	.06	.18	
oreign	7,567	6,303	3,807	24,154	12,610	1.21	. 58	
Total-All Makes	564,272	545,234	651,855	1,988,696	2,180,371	100.00	100.00	

^{*} Based on data from R. L. Polk & Co.

of his success to the fact that his advertising budget has been stepped up 39.5 per cent over that for 1955.

Speaking at a recent press conference in New York City, Mr. Milner stated that at the moment his principal problem is getting enough cars to sell under present production cut-

backs. Providing he gets all that he needs, he expects total 1956 sales of his dealerships to surpass last year's \$60 million mark. While admitting that his profit per car is down close to one per cent over that of 1955, Mr. Milner pointed out that his dollar volume is up 24 per cent over last year.

TRUCKS COUNTER CAR DECLINE IN STEADY UPSURGE 1956 New Truck Registrations*

Arranged by Makes in Descending Order According to the 1956 Four Months' Totals

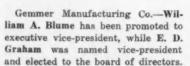
				FOUR MONTHS				
				U	nits	Per Cent of Total		
MAKE	April 1956	March 1956	April 1955	1956	1955	1956	1955	
Chevrolet	27.531	26,305	24,860	98,255	78,732	23.70	28.89	
Ford	25,073	22,777	27,993	85,685	91,369	29.39	34.87	
nternational	9.950	9.550	9.334	35,450	33,300	12.16	12.71	
3. M. C.	7,516	7,136	4.091	28,514	17,369	9.78	6.63	
Dodge	5.078	4.746	5.026	17,827	20,745	6.12	7.92	
White	1.540	1.210	1.239	5.301	4,210	1.82	1.61	
Vlack	1,251	1.147	1.000	4,225	2,860	1.46	1.09	
Willyn Truck	1.285	1,127	1.471	4.222	5,270	1.45	2.01	
Studebaker	857	844	1,120	3.395	3,742	1.18	1.43	
Willys Jeep	717	712	935	2.535	3.024	.87	1.15	
Diamond T	386	375	327	1.368	1.093	.47	.42	
Divon	309	321	269	1.095	982	.38	.37 .31 .12	
300	293	243	297	945	818	.32	.31	
Conworth	109	87	87	370	316	.13	.12	
han down	128	78	94	337	366	.12	.14	
4 4 444	55	36	44	150	123	.05	.14 .05 .03	
eterbilt	37	36	18	145	75	.06	.03	
Aisc. Domestic	138	73	67	366	225	.13	.00	
oreign	446	398	190	1,324	408	.45	.18	
Total-Ali Makes	82,699	77,220	79,071	291,509	262,027	100.00	100.00	

^{*} Based on data from R. L. Polk & Co.

Men in the News



American Motors Carp.—R. H. Isbrandt has been appointed director of engineering.



American Steel & Wire Div., U. S. Steel Corp.—Maxwell D. Millard has been appointed general manager of sales.

Oldsmobile Div., General Motors Corp.—Thomas E. Darnton has been made marketing research manager.

Kearney & Trecker Corp.—R. O. Tjensvold is now manager of labor relations; Alphons J. John, manager of employe and community relations; Harold W. Francke, advertising manager; and Joseph P. Bliss, manager of training.

General Motors Corp.—Howard W. Megee was appointed general assistant comptroller, while Franklin H. LaRowe and John P. Sullivan were made assistant treasurers.

Holley Carburetor Co.—Ralph N. Sather is now assistant treasurer.

Amplex Div., Chrysler Corp.— Lawrence G. Hintz and Franklin M. Rogers have been made industrial relations manager and comptroller, respectively.

Moraine Products Div., General Motors Corp.—Jean A. Lignian has been appointed manager of quality control.

Dodge Div., Chrysler Corp.— Richard L. Shugg, Jr., has been made sales promotion manager for cars and trucks.



Purolator Products, Inc.—Joseph G. Van Nest has been appointed vice-president in charge of organization.



Joseph T. Ryerson & Son, Inc.—Herbert G. Dent has been appointed director of the Plant Engineering Div., while George M. Harding has been made director of the Operating Controls Div.

Redmond Motor Co.—Robert E. Drury has been elected vice-president and assistant secretary.

Burgess Battery Co.—Charles E. Balz is now vice-president for sales.

Wagner Electric Corp.—P. C. Ford is now executive engineer for automotive and electrical engineering research and development.



Buick Motor Div., General Motors Corp.—E. C. Kennard was named assistant general sales manager in charge of the home office staff.

Oakite Products, Inc.—J. J. Basch has been elected vice-president.

Beryllium Corp.—Walter R. Lowry was elected president.

GMC Truck & Coach Div., General Motors Corp.—W. L. Vande Water was made executive assistant to the general manager in charge of dealer relations.

Plymouth Div., Chrysler Corp.— Stephen M. Lacko was made director of budget, manufacturing.

Pratt & Whitney Co., Inc., Machine Tool Div. — Richard D. Keller was named assistant sales manager.



Vickers, Inc.—W. F. Driver was made manager of industrial products sales.



Cincinnati Lathe & Tool Co.— David A. Wallace and E. L. Ritter have been elected vice-president in charge of sales and vice-president in charge of engineering, respectively.

Datamatic Corp.—Walter W. Finke has been elected president.

Necrology

Cecil B. Thomas, 61, a vicepresident and director of Chrysler Corp. and president of the Export Div., died June 11, at Grosse Pointe, Mich.

George E. Hallenbeck, 78, retired chairman of the board of Baker Bros., Inc., died recently, at Toledo, O.

Carl W. Johnson, 69, senior vice-president of Clevite Corp., died June 5, at Detroit, Mich.

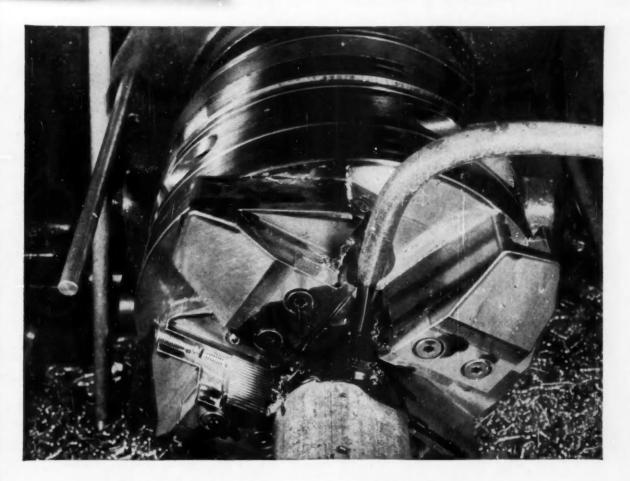
Robert E. Murphy, 50, assistant counsel for GM Overseas Operations Div. of General Motors Corp., died June 3, at Rockville Centre, N. Y.

John L. Slade, 33, administrative assistant to the vice-president of Black & Decker Mfg. Co., died June 1, at Hampstead, Md.

Arthur T. Hauch, first president of National Standard Parts Association, died recently, at Hillsdale, Mich.

Norman A. Lincoln, 56, former purchasing agent for the Aircraft Div. of Willys Motors, Inc., and A. O. Smith Corp., died May 28, at Toledo, O.

Bob Sweikert, 30, winner of the 1955 Indianapolis Race, was killed in a racing accident June 17, at Salem, Ind.



Excellent tool life... high quality threads

A prominent nipple manufacturer in Texas (name on request) manufactures nipples from seamless tubing, galvanized pipe and heavy wall tubing-in sizes from 1/8-inch to 8 inches. Landis Dual Head Automatic Threading Machines are used.

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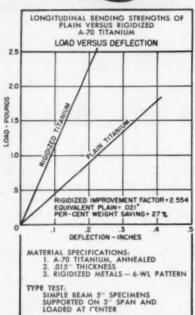
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CUTTING, GRINDING,





Titanium is the newest metal to be improved by Rigidizing. Stiffness is increased 155% and more, so that thinner sheets can be used to give bending strength equivalent to heavier sheets. This represents a saving in weight up to $27\%\ldots$ making the use of titanium practical cost-wise, for many new applications.

Shown above is a jet engine shroud of titanium RIGID-tex Metal, developed for the U.S. Air Force F-102A Supersonic Interceptor. Formerly these shrouds were made of plain sheet titanium but no matter how tightly the sheets were riveted, the metal would wrinkle. Now using the new, lighter-gauge titanium RIGID-tex Metal, wrinkling and buckling due to expansion and contraction are compensated for, by the pattern.

And just as Rigidizing conserves titanium by permitting the use of lighter gauges, the same cost saving results are obtained with stainless steel, aluminum, and other metals. Investigate also, the many other advantages of RIGID-tex Metal, its mar-resistant beauty, its glittering texture, its anti-glare properties. The applications of RIGID-tex Metal are limited only by the imagination!

RIGID-tex Metal is available in stainless steel, aluminum, titanium—in fact any metal . . . any finish . . . any color, solid or perforated. There are more than 40 standard patterns from which to choose.

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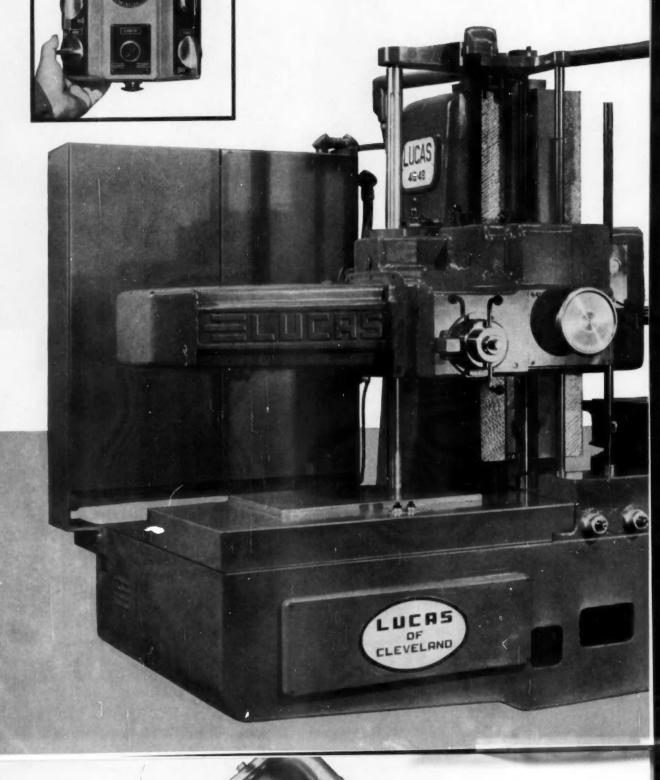
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pendant handles all motions of the Lucas — faster

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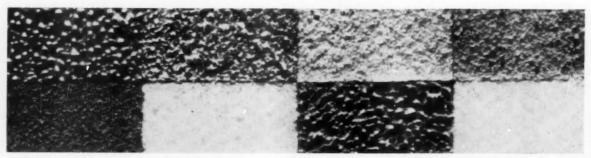
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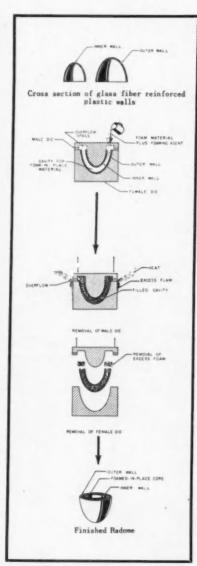
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Densities available in expanded resins



Sequence of usual steps in the foam-inplace phase of making a reinforced plastic radome. Male and female dies are held securely, heat action from foaming agent or applied heat causes material to foam and fill void; dies prevent deformation of walls, and overflew is provided for excess foam.

Expanded Resinsfor Aircraft Applications

URING the past few years there has been a decided increase in the development of expanded resins for aircraft use. Potential applications of these materials include uses such as potting of components, providing rigidity to hollow members, and insulation against heat or vibration.

The use of expanded resins in the manufacture of aircraft has generally been in applications where property requirements obviated the use of conventional materials. For example, expanded resins are used in the manufacture of various radomes, including those used on the F-89 because of their desirable electrical properties. The radome consists essentially of an inner and outer layer of glass-fiber-reinforced resin with a foamed-in-place middle layer which provides the necessary rigidity and yet allows unrestricted passage for radar waves.

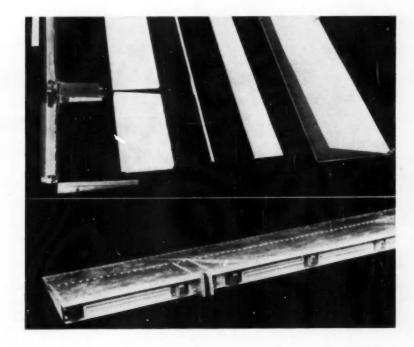
The use of expanded resins as potting compounds is increasing rapidly. The embedding of electronic, electrical or other delicate assemblies in expanded resin provides protection against such hazards as temperature extremes, excessive vibration, sonic disturbance, fungus contamination, and moisture. The additional weight of potting materials may be relatively small, especially if low-density expanded resins are specified.

Foamable aircraft materials include various resins such as phenolics, polyesters, or isocyanates which exhibit sufficiently desirable properties to compensate for the research and development required to obtain the data necessary to justify their use in design. Expanded resins may have cells which are closed, open, or are a combination of both. Commonly used foams weigh from approximately 1.5 to 35 lb per cu ft. Consistency of foamed resins varies from soft to rigid. Most expanded resins are very good thermal insulators with a K factor (Btu/hr/sq ft/in/F) ranging from 0.20 to 0.35.

Expanded resin formulations are available with dielectric constants ranging from approximately 1.15 to 1.35, and with a dissipation factor of less than 0.01. Thermal expansion coefficients of expanded resins vary greatly and their use becomes prohibitive when temperature changes increase the dimensions of a specific formulation to such an

Pretoamed resin assemblies require very close tolerances because the foam must be cemented in place. Upper illustration shows components; lower photo is a view of an assembled elevon.





extent that assembly tolerances are exceeded. This phenomenon is more likely to cause trouble with prefoamed materials than with those which are foamedin-place.

Formulations are available which are reported to be satisfactory for use in service temperatures up to 500 F; however, applications must be evaluated individually until more is known about production and service characteristics of these materials. Currently used materials at Northrop have a maximum temperature limitation of 300 F.

Altitude changes have very little effect on many foams, for instance, at room temperature, low density (2.5 lb/cu ft) 'Lockfoam' expands approximately 0.57 per cent and a medium density foam (8.5 lb/cu ft) expands about 0.03 per cent between sea level and 60,000 ft.

Resins are expanded by adding gas forming ingredients so that the gas will be released at the proper time and jelling or solidification will be simultaneous with the completion of the foaming action. The foaming phase of expanded resin manufacture is usually associated with heat and chemical action. Most expanded resin formulations require a post-foaming 'cure cycle' which consists of heating the resin to the proper curing temperature and holding it at that temperature for a predetermined length of time. The cure cycle is usually different for each type of resin. The manufacture of a foamed-in-place resin radome assembly is illustrated.

Prefoamed resins are furnished in sheets or blocks, then contoured to the configuration of the cavity for which they are intended. Conventional wood working tools are satisfactory for cutting or contouring most prefoamed resins. Preformed resin assemblies require very close tolerances because the foam must be cemented in place; the integrity of glue lines determines the load carrying ability of these resins. Prefoamed assemblies must be made to ensure 'glue-line' tolerances of +0.005-0.000 in. per glue line (or +0.010-0.000 in. for the assembly which involves two glue lines).

Foamed-in-place resins are usually furnished as liquids (although they may be powder or granular) which are introduced, in correct amounts, into the cavities for which they are intended. Foamed-in-place resins should not be introduced into cavities which are not water tight because the resins will probably leak out due to the foaming pressure or be extruded through openings during the process of foaming. Good judgment should also be exercised in selecting a resin which does not require a cure temperature greater than that which can be safely applied to all components of the specific assembly.

The post-foaming cure cycle servies to complete the polymerization of the resin and is usually accomplished by applying heat. The expanded resin formulations used by Northrop require a cure temperature of approximately 225 F, while temperatures up to 500 F are required for some formulations, such as the silicone resins, to effect a cure. The prefoamed resins are generally purchased in a fully cured condition; however, the bonding agents used to hold prefoamed resins to other assembly items often require a 'heat-and-pressure' type cure cycle.

For foamed-in-place resins, the bond strength between the core and face skin usually exceeds the internal strength of the foamed core; however, one some surfaces such as hard anodized aluminum, a primer may be required to ensure proper adhesion. The

(Turn to page 112, please)

Detroit's First Annual Conference on Tooling and Materials

DETROIT'S First Annual Tooling and Materials Conference, held June 14 at Wayne University, was an unqualified success, drawing an attendance of some 300 people. It was co-sponsored by the Wayne University Materials Management Center and College of Engineering, The Detroit Chapter of the American Society of Tool Engineers, The Detroit Chapter of the American Society for Metals, The Engineering Society of Detroit and the Detroit Board of Commerce. The program was quite varied in scope and covered 16 formal papers as well as one at the banquet.

R. L. Sims and C. B. Sung, Bendix Aviation Corp. Research Laboratories, discussed the application of tape controls for machine tools. The significance of the presentation was that Bendix now is prepared to supply tape controlled devices for application on commercial machine tools for all industry. This three-dimensional control system can be employed for a variety of types of machines and is particularly adaptable to the machining of intricate parts. It is said to result in faster and more accurate machining than conventional methods.

Titanium-carbide sintered tool materials are the latest of the carbides to be made available to the machine shops of the industry. Formulations of titanium-carbide also are being developed for the production of structural parts such as turbine buckets, nozzle rings, impellers, tubing for thermostatic controls, and other special and intricately formed parts subject to high temperatures and thermal shock, according to a presentation by J. C. Redmond, Kennametal, Inc. Among the unique properties of this composition, when used in sintered form, are: high tensile and compressive properties; high modulus of elasticity combined with low density; excellent high temperature properties and good endurance values at elevated temperatures; and low compressive creep values at 1800 F combined with unusual thermal shock resistance.

Kirkpatrick and Van Becelaere of Brooks and Perkins rovered the area of magnesium, titanium, and zirconium from the standpoint of physical properties and applications. It was pointed out that some titanium alloys exhibit tensile strength up to 200,000 psi. Titanium is said to have excellent formability and parts with extremely deep draws can be readily produced by hot drawing, by spinning, and by means of press brakes. Something new is available in a magnesium-thorium alloy which has excellent heat resistance.

According to Kirkpatrick, the current production of

light weight materials is about as follows, in terms of yearly tonnages: aluminum—two million tons; magnesium—75,000 tons; titanium—15,000 tons, with a going price of around \$18 per lb; zirconium (primarily for AEC) about 1000 tons with a going price of \$34 per lb.

One of the most provocative discussions of the meeting was concerned with a report on the use of ceramic cutting tools in metal cutting, presented by R. T. Hook, Warner & Swasey Co. Having made a thorough study of the subject, Hook mentioned that the USSR claims to have made great strides in the utilization of ceramics and claims a wide range of applications. If the literature is to be taken at face value, the USSR began experimenting with ceramic tools in 1948 and should be about five years ahead of practice in this country.

Although a considerable number of companies, including Carboloy, Norton, Carborundum, Vascoloy, and U. S. Ceramic Tile Co., are producing ceramic tool bits, the technique is still new and much more experience must be gained before this tool material can be said to offer real competition for the sintered cemented-carbides. In fact, the author implied that the appearance of this new cutting material should have the effect of intensifying the utilization of cemented-carbides, particularly the newer formulations such as titanium-carbide, and titanium-boride which is still experimental.

According to Hook, the ceramic tools are essentially formulations of aluminum-oxide, regardless of their make. Where successful applications have been made, the ceramics produce faster metal removal with better surface finish and are particularly effective in cutting the "hard-to-cut" metals. Cutting speeds from 400 to 1400 sfm are routine with some applications ranging up to 3000 sfm, where the equipment is capable of handling such speeds. Depths of cut have ranged from 0.010 to 0.300 in. In the literature the USSR claims speeds up to 11,000 sfm.

Hook recommends the use of clamped-on tool holder designs, using carbide shims under the ceramic and between the edge of the ceramic and the shoulder of the tool holder. Carbide chip breakers, where employed, are brazed to the shank. It is important to note that clamping must be extremely rigid to prevent breakage. A representative of Syntox, the British producer credited with introducing ceramic tools to the U.S.A., reported excellent results in production, and mentioned that current developments include an

(Turn to page 104, please)

Many Automotive Subjects Discussed

at ASQC Convention

A UTOMOTIVE and aircraft papers predominated at the 10th Annual Convention of the American Society of Quality Control in Montreal last month. Altogether, there were more than 85 speakers and moderators on hand for the three-day meeting. Automotive papers covered quality control in such phases of the industry as automation, gage tolerances, engine assembly, engine manufacturing, frame production, and electrical equipment. Two speakers covered bonded assemblies in the aviation portion of the meeting. Other aircraft subjects dealt with quality control for production planning, reporting methods, overhaul time, and laboratory testing.

Presented herewith are extracts taken from three of the papers in the automotive and aviation group.

MACHINE CAPABILITY

By Irwin A. De Grote

Engine and Foundry Div.

THERE are numerous and varied cyinions as to the correct method of marking machine capability studies. I believe, though, that it must be based on statistical methods. In the Engine and Foundry Division, an approach is used which is sound and about as simple as we know how to make it and still take advantage of the probability theory, which is the foundation of all statistical quality control.

Machine processes differ greatly in nature, and a flat, across-the-board standard allowance is not possible. Each case must be decided on its own set of circumstances.

It is Ford's experience in production, however, that jobs presently successful from the quality standpoint are generally those in which basic machine variation consumes no more than ¾ of specification tolerance. This approach does not deprive the machine builder of any part of total specified tolerance. It does not require him to provide a machine which is in any degree more precise than it should be. But it does enable him to judge by actual trial whether the machine is likely to be adequate, quality-wise, for the production operation it was designed to perform. It would be found, in fact, that any machine now making quality parts in production has basic variation, which can meet such tests of capability. On the other hand, those which would fail such tests, presently result in high scrap and rework

costs. If at all possible, the tests should be made on the machine builder's floor. There are good reasons for this:

First, because the builder will then have a record to show that the machine was capable before leaving his plant.

Second, because any corrections that are required can be made in his plant where he has the right equipment and can, therefore, do the job more easily and at lower cost to him.

Third, because it will save him money on the expense of service men, who may spend weeks or even months in the purchaser's plant, trying to correct something, with inadequate facilities or time limitations, that could have been prevented by a few hours' work in the builder's plant.

The advantages to us, the purchaser, are obvious:

1. Better quality.

2. The elimination of "bottleneck" operations due to inability of the machine to produce parts within tolerance.

Another facet of capability studies is the assistance to manufacturing engineering in determining which of two or more processes produces the best quality part. This would include the type, design, and make of machine, as well as the best sequence of operations. You might be asked, as we were, "Is it better to rough and finish bore the cylinder block in the same operation or is it better to rough bore, complete the other operations, and then finish bore?" This is the type of information we compile to report to the manufacturing engineering section. They then use these statistical facts and proof, along with experience and other factors, as a basis for decisions.

DEVELOPING A QUALITY CONTROL PROGRAM FOR AUTOMATION

By B. P. Seipel

Studebaker-Packard Corp.

To develop a complete quality control program that will effectively measure, analyze and control the capabilities and efficiencies of an automated process, three basic factors are required:

(Turn to page 102, please)



Perspective of first section of the cylinder block machine line, an imposing array of special Footburt unit type machines. Noteworthy feature of this equipment is the provision of automatic loading and unloading in each unit. The rollover fixture in the foreground is employed for turning the block in the correct position for a given machine.

Moderate
Volume
Production
of

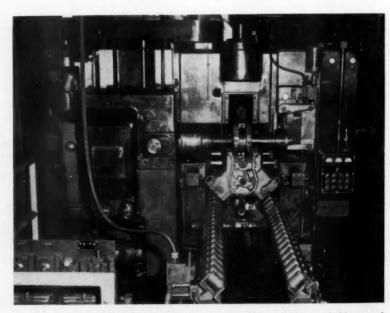
HE industry-wide impact of the overhead valve V-8 engine has been accompanied by the introduction of outstanding new plants and equipment and advanced methods, lifting mass production techniques to a higher level than ever before.

Because of mass production requirements it has become imperative to take advantage of costly drilling and boring transfer machines, automatic material handling, enormous surface broaching machines, and the other techniques that have been harnessed to large volume manufacturing in recent years.

But what are the alternatives open to management in launching a brand new heavy duty V-8 engine in the relatively smaller numbers associated with motor truck and bus production? That was precisely the problem that confronted International Harvester Co. management when it placed its new V-8 in production recently. The normal volume requirement for these big engines cannot justify such transfer machines, or automatic handling methods, or the high production surfacing equipment used so widely in motor car engine plants.

Yet despite the limitations im-

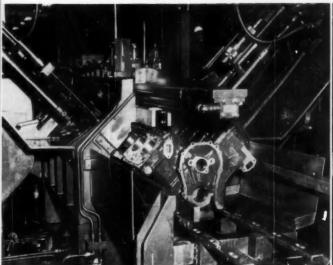
V-8 Engines for Trucks at



First operation on the cylinder block line is the milling of bearing bridges and pan rail in this Sundstrand Rigidmil. It also drills and reams all locating pin holes.

posed by volume, International Harvester had to create a facility capable of meeting exceptionally high quality standards at costs that are competitive in a highly competitive industry. A few examples, perhaps, will show how management achieved its objectives.

Instead of surface broaching,





Above, left—Close-up of Barnesdrll two-way, two-spindle Plugmatic honing machine for honing cylinder bores.

International Harvester

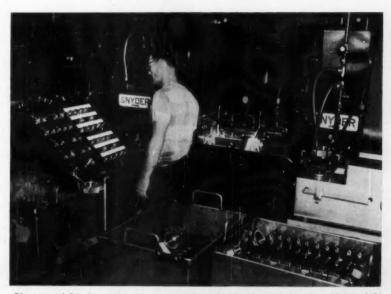
Harvester has turned to the modern and highly efficient milling machines. In place of transfer machines, the company is employing individual, unit - type, single-purpose equipment of waytype-including two-, three-, and four-way machines. The cylinder block line is particularly noteworthy in the arrangement pictured here. Blocks move along the machine line on gravity roller conveyors. Howevez, each of the Footburt machines is equipped with automatic loading and unloading, as will be described later, to facilitate handling at each station.

Precision balancing of reciprocating and rotating parts is an important part of the program; although the speed is high, the bore is large and the components heavier than in a passenger car engine. Precise balancing is employed on crankshafts, connecting rods, pistons, and flywheel to assure fine balance of the complete engine.

The single-purpose equipment designed for this engine is noteworthy and distinctive. Here we noted what, to us, was the first Above, right — Interesting adaptation of Avey deep hole drilling heads is seen here in a setup for drilling anguler oil holes in V-B crankshafts. The work is held in vertical position in the central fixture.

 B_y

Joseph Geschelin

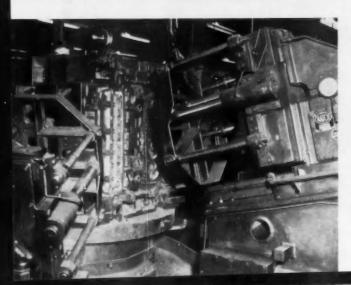


Close-up of Snyder automatic connecting rod balancing machine in which weight bosses at each end are milled to establish uniform weight rods. The rod is first weighed at the Shadograph station at the right, the reading being communicated automatically to the electronic control unit which automatically moves the milling heads into proper cutting position.



Example of one of the Natco waytype machines on the cylinder head
line. This one
drills mounting
holes in intake
and exhaust manifold mating faces.





example of the Barnesdril Plugmatic type cylinder bore honing machine. Of interest, too, is the method of crankshaft oil hole drilling in a vertical position. Another feature is the finish-grinding of the big end of the connecting rod in a Heald Gage-Matic internal grinder.

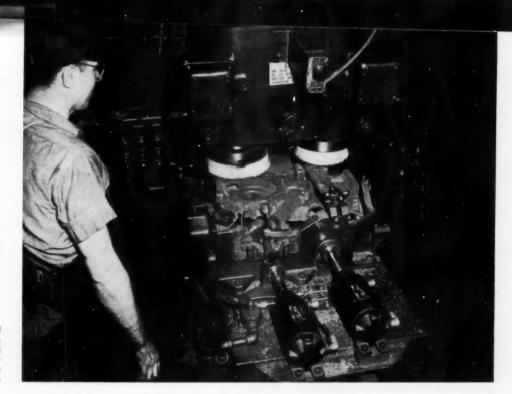
Consider now some highlights of the cylinder block machine line. Operations begin with milling in a massive Sundstrand Rigidmil. Among other things this operation finishes the pan rail, rough mills the bearing cap seat, and drills and reams dowel pin holes to serve as locators for succeeding operations.

Many of the detail drilling, reaming, tapping, counterboring, etc., steps, shown in the illustrations, are handled in sequence in the long line of special Footburt machines. These are of way-type and either complete the operation in one setting or require removal of the block, rotation on the turntable, and re-entry into the fixture for another cycle.

As illustrated, each machine is fitted with an automatic loading device operated by a fluid motor. In each instance, the operator pushes the block onto the turntable, turns the block into its proper position, and pushes it to engage the automatic loading mechanism. From this point on the entire cycle is fully automatic. The block is brought into proper position in the fix-

Above, left—Looking down on the work station of the Cincinnati Duplex Powermatic milling machine which mills exhaust and intake manifold faces as well as both ends of V-8 cylinder heads.

The unique Natco angular dial type indexing machine for handling spark plug hole operations on cylinder heads.



The small, vertical type two-spindle Newton milling machine for milling crankcase front cover faces.

ture, clamped automatically, and the machine cycle initiated. Upon completion of the machine cycle, the block is automatically unloaded. In cases where another cycle is required in the same machine, the operator turns the block on the turntable and then initiates the automatic cycle once more. Because of such automaticity it is a simple matter for one operator to handle as many as six machines on the line.

It may be noted that each of these Footburts employs bar type ways. Engineers here feel that bar type ways provide for better alignment and rigidity and will require less maintenance.

At the end of the rough machining section, and later on just before the final operations are performed, there is a special combination vibrator-turntable-rollover fixture for removing chips.

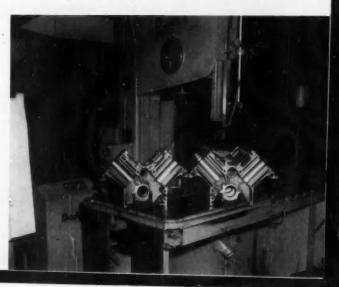
The cylinder bore is rough-bored in an Ingersoll near the beginning of machining, later semi- and finish-bored in one setting in another Ingersoll. Honing is done in a new, V-type Barnesdril Plugmatic which hones only one bore at a time on each side to avoid distortion. Honing is held to precise limits, bores being graded in four sizes in increments of 0.0005 in.

Crankshaft machining is conventional, employing (Turn to page 117, please)

Above, right—Special arrangement of a Gisholt Dynetric balancing machine for dynamic and static balancing of V-8 flywheels. Drilling correction readings at both ends are set up on the calibration dials at the top, followed by drilling at both ends. Memory unit is manually set up.

Large Do-All hydraulic feed table saw used for sectioning major castings to assure maintenance of proper wall thickness at critical areas.





Major Engine Projects Unveiled at SAE Summer Meeting

By James R. Custer

POUR new engine developments highlighted the Summer Meeting of the Society of Automotive Engineers early last month at Atlantic City, N. J. Most sections of the country were well represented with 1450 engineers, technicians and company executives in attendance.

In addition, a wide range of engineering subjects were discussed in 32 papers at 14 technical sessions, including six symposiums. Five roundtable conferences were devoted to the latest developments in pas-

senger car seating, automotive safety research, automotive applications of plastics, truck tubeless tires, and splitter ratios in truck transmissions and axles.

Biggest sensation at the Summer Meeting was the General Motors free piston-turbine engine. Arthur F. Underwood, GM Research Staff engineer, in a paper presented a comprehensive analysis of this type of powerplant and described one of the units developed at the GM Technical Center for automotive use. Designed as a Siamesed unit, the first of its kind, this

— GMR 4-4 Hyprex Engine — A Concept of Free Piston Engine for Automotive Use

By A. F. Underwood GENERAL MOTORS RESEARCH STAFF

THE most novel feature of the concept of the Hyprex free piston engine is that it is a siamesed unit. By siamesed is meant a common case for two complete cylinder assemblies, a common air box, a common air inlet housing and a common exhaust. This configuration was selected after careful consideration of the many types of possible designs. It should be pointed out that gasifiers have been "twinned." Twinning is accomplished merely by running the exhaust from two gasifiers into a common header and dephasing the two machines by an appropriate pneumatic device.

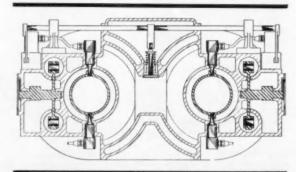
One of the principal differences of opinion among free piston engine engineers is whether the engine should be an outward compression type or an inward compression type.

In the case of a single-cylinder outward compression gasifier, the engineer finds an improvement in efficiency over an inward compressing type. This is brought about by the fact that the outward compressing engine supplies its air to the air box during the time when the exhaust ports are open and the engine is being scavenged. The result is a lower pumper loss and, therefore, a small percentage gain in overall efficiency. The disadvantage of an outward compressing machine is that external air pipes must be added to conduct the

compressed air from the ends of the machine to the air box. Also in order to get good control of the engine speed, the bounce chamber is usually added on to the end of the air compressor cylinders. This results in an overall increase in the length of the machine.

The inward compressing type has the advantage of smaller dimensions both in length and height. Another real asset is the comparative ease with which such a machine can be assembled for inspection. Therefore it is obvious that if the inward compression engine can be made to give the slightly improved thermal efficiency of the outward compression engine,

Fig. 1—Section of GMR 4-4 Hyprex engine.



engine has a maximum output of 250 hp and now powers the XP-500 car, which was displayed during the meeting. This new free piston engine has been designated the GMR 4-4 Hyprex (high pressure and expansion). A description of it is given elsewhere in this article.

The Ford engineering delegation made a surprise disclosure during the discussion period after the Underwood paper by letting it be known that they have a free piston research program at the Ford Scientific Laboratory. In an unscheduled appearance Dr. Gordon H. Millar gave a brief description of the Ford project, showed some charts of test results and a photograph of a 50-hp free piston engine under development at the Ford laboratory. A summary of his remarks is included with this article.

Another important engine program was related in a paper on International Harvester's new truck type V-8, which is being built in three sizes of 401, 461 and 549 cu in. displacements. G. R. Beardsley and A. A. Catlin, of the IHC Motor Truck Division, described the salient features of this family of engines (see June 1 issue of AI) and the engineering approach used in the development program, some of which is explained in the extract in this article.

Reporting on third gas turbine which has been developed by General Motors, William A. Turunen and John S. Collman of the GM Research Staff presented a paper on the GT-304 Whirlfire gas turbine incorporating a rotary regenerator to improve fuel economy and other performance characteristics. This engine is used to power the Firebird II car, which was described in a paper by J. B. Bidwell and R. E. Owen, GM Research Staff engineers. In addition to the regenerative gas turbine, other major features in the car include an automatic starting system, acgenerator and rectifier, electric gearshift, all-metal disk brake with turbo-cooling system built into the disk, an air-oil suspension system, and central hydraulic system.

The big question is "Will the gas turbine and free piston engine be first rate challengers for the automotive piston engine, and if so, how soon?" Both still have a long way to go to catch up to it commercially for motor vehicle propulsion.

The engineers concentrated on timely engineering problems during the symposium sessions, including corrosion and cavitation in engine cooling jackets, volatility of fuels, status of aluminum radiators, an analysis of where the power goes in a car with a V-8 of 200 hp (bare engine) corrected to standard SAE conditions. Braking problems were studied in two symposiums, one on vehicle retarder systems and the other on emergency braking systems for combinations of commercial motor vehicles.

Extracts from some of the outstanding papers are presented herewith:

the arrangement would be one which combined the better points of each configuration. The siamesing accomplishes this because with dephased assemblies in a common case, one cylinder is being scavenged while the other power piston assembly is compressing the scavenging air into the common air box.

Another important advantage of the siamesed design is the compactness of the engine for a given horsepower. Less engine noise would be expected from siamesing due to more even air intake pulsations and to having two cylinders firing at regular intervals.

While there is currently no definite information on the effect of the pulse discharges from the gasifier on the efficiency of the gas turbine, it is believed desirable to have as uniform a gas pressure as possible at the turbine inlet.

Description of the Hyprex Engine

The first consideration in laying out a new engine is to determine the horsepower or performance characteristics which it must meet. The present engine was based on a nominal 250 gas horsepower. Because of the low-speed characteristics of the gas turbine, this would give a performance comparable to what is currently referred to as a 300 horsepower automobile engine. The nominal dimensions of the gasifier are 40 in. long, 34 in. wide and 18 in. high. The model number of this engine is the GMR4-4, denoting two cylinders of four inch bore.

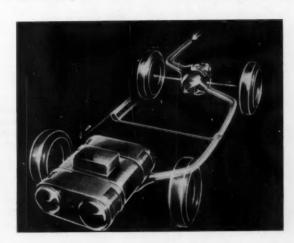
Using the siamesed principle the power cylinder is four inches in diameter, the air compressor piston is 11 inches in diameter and the stroke is approximately five inches. A maximum cyclic speed of 2400 strokes per

minute was selected. The actual cyclic speed is determined by the weights of the moving parts, the amount of recirculation and the fuel rate. These have been varied in our testing and the minimum speed can be in the order of 1000 cycles per minute.

As can be seen from Fig. 1 the engine does have a common air inlet housing, a common air box for scavenging and a closely siamesed exhaust outlet.

The inlet valves and exhaust valves

Phantom view of arrangement of Hyprex free piston powerplant in XP-500 chassis.



are identical. There are eight inlet valves and six delivery valves for each air compressor. Previous tests have indicated that the reed type gives the best performance with respect to highest operating speed and best volumetric efficiency. The design is such that the bodies can be die castings and the blades are simple steel stampings.

The steel pistons are of a conventional design with heat dam and oil cooling. The oil for this purpose is also used for general lubrication of the engine parts such as the connecting linkage. Lubrication for the power pistons is provided directly to the cylinder walls and indirectly from the air compressors. The wear bands on the piston are made of aluminum coated steel. Tests on a larger engine indicated that the one component which was affected by sulphur in the fuel, was the copper lead coated wear bands. By the use of the special aluminum alloy, during several thousands of hours of testing, it has been demonstrated that there is no chemi-

A separate fuel injection pump and nozzle are used for each cylinder. The pump is actuated by a cam on the linkage mechanism.

The successful operation of a siamesed unit is dependent on the dephaser. Its action is to keep the two piston assemblies 180 deg out of phase. The pneumatic device used on this engine, obtains its signal from the bounce chamber pressures. In general, the action is to accelerate or retard the cyclic speed of one piston assembly, in relation to the other piston assembly, in order to main ain the proper timing. Actually the engine starts in parallel operation and then within a few strokes is forced into dephased operation.

The starter follows the usual practice of putting the pistons into a proper position near their outer dead points. Admission of air into the bounce chambers suddenly forces all of the pistons to their inner dead points compressing the air in the combustion space. Fuel is injected, combustion takes place, and the piston assemblies are accelerated outward. Then the control mechanisms must take over and determine promptly the correct cushion pressure for the amount of fuel which is being injected so that the engine will not understroke. As with all free piston engines of the inward compression type it is essential that proper firing be present on the first stroke as there is no carry over of inertia for a second stroke. The most critical stroke is the second, as the controls must "take over" and adjust the bounce pressure in relation to the injected fuel or the engine will stop. In other words, if the engine does not start on the first stroke and if the controls do not properly regulate thereafter, it is necessary to again go through the starting steps. Air pressure for starting can be obtained from air bottles or from an air compressor of sufficient capacity to furnish the air directly for each start. Air pressure of 30 psi in the bounce chamber is adequate to start this engine.

From the engine the exhaust is con-

ducted through a 3½ inch diameter pipe which runs through the left frame of the car as shown in Fig. 2. A standard type of insulation surrounds the pipe to reduce losses and to minimize the heat which would enter the body in the summertime. It has been suggested that the heat losses might be used for car heating during the winter. The low temperature of the gas allows it to be easily conducted from practically one end of the car to the other.

The present gas powered turbine is a five stage axial flow unit. Its stall torque characteristics are those which are normally found in such a turbine;

Ford Free Piston Engines

By Dr. Gordon H. Miller and Paul Klotsch FORD SCIENTIFIC LABORATORY

For some time a free piston turbo-compound engine development program has been in existence in the Scientific Laboratory of the Ford Motor Co. The objective of this program has been to take a good look at the possible advantages offered by the free piston turbo-compound engine.

To implement this process several experimental free piston gasifiers have been designed and built. These machines are relatively small in size and operate at frequencies up to 3600 cpm (aluminum pistons).

Laboratory work with these machines has been directed towards obtaining a better understanding of the operation of free piston machinery above the usual 1000 cpm range. It is further desired to evaluate on a laboratory basis the piston motioncombustion process relationship under as many and as varied conditions of operation as can be achieved.

The results of this program have been surprising and significantly interesting. It is advantageous to itemize the results in the following broad categories:

- 1. Mechanical Design
- 2. Thermodynamic Performance
- 3. Stability and Control

With regard to the mechanical design it has been apparent from the results of engine tests that one pair of synchronizing rods is entirely adequate to keep the pistons in phase. The second set of rods is excess baggage and the attendant difficulties with alignment and fastening do not justify its existence. Motion studies by means of high speed photograph

International Harvester's Approach to V-8 Engine Program

By G. R. Beardsley and A. A. Catlin
MOTOR TRUCK DIVISION I.H.C.

WE will briefly describe the salient features of these engines and the engineering approach used in the V-8 engine program. (Engineering and production articles on this new IHC V-8 were published in the June 1 and June 15, 1956 issues of AUTOMOTIVE INDUSTRIES.)

Bearing Loads

The first intensive study involved

bearing loads. The final selection of crankshaft and connecting rod bearing loading followed a review of bearing industry progress in the last decade and anticipated progress, insofar as possible, during the projected life of these engines. Consideration was given to the peak combustion pressures and rotating speeds that may become permissible with expected advances in the qualities of

as would be expected, the turbine gives excellent torque multiplication in itself. The power output from the turbine is through a gear box having a reduction ratio of approximately 7 to 1. The rear wheels are independently suspended in order to allow the mass of the turbine gear box, transmission and differential to be fastened solidly to the chassis.

Hyprex Performance

At the time of writing this paper complete engineering data were not available, however, a specific fuel value under 0.45 lb per gas horsepower hour was obtained during the preliminary testing. On the basis of 25,000 hours of testing on various free piston engines of the same approximate bore it is expected to reach soon a value of 0.40.

The turbine on the XP-500 is the first one we have ever made for a gasifier. However, it has shown an efficiency of about 70 per cent and very fortunately this efficiency is maintained over the speed range for the road load requirements of the automobile.

Chassis and Body

The chassis was especially designed for the XP-500. The side frames are

large enough to house the insulated pipe connecting the gasifier to the turbine, on the left hand side. The right hand frame is used to conduct hydraulic power tubing and other lines from the rear to the front of the car. Because the engine has a small overall height, cross members can be placed across the engine compartment to tie the side frames together, thereby stiffening the frame. A standard automobile fuel tank is contained in the rear trunk of the car. (Suspension, steering and rear wheel drive are of the same design as those in the Firebird II chassis, described in this article.-Ed.)

revealed piston motion characteristics unlike any known engines.

During the course of operation the effect of the combustion process on the piston motion, and the converse, were studied. There is no question but that the variable stroke and lack of a fixed volume-time path are important influences on combustion in free piston machinery.

Gasifiers have been operated in the Scientific Laboratory on both gaseous and liquid fuel on both spark ignition and compression ignition at practically all concievable air/fuel ratios. Carbureted and injection type fuel systems have been used interchangeably. It has been found possible to run at low power levels on spark ignition and as the pressure ratio is increased to automatically change to compression ignition. This type of operation on gasoline type fuels was practically undetectable except on a pressure-time card.

Under some conditions of operation pre-ignition was experienced but careful attention to combustion chamber details eliminated the problem.

Propane was also used as a fuel with spark ignition and direct solid fuel injection was operated both with and without spark ignition. The completely different response of these experimental gasifiers to the normal parameters of fuel quality remains a major research effort.

Control of the free piston gasifier requires a basic knowledge of many parameters. Under some conditions of operation instantaneous starting and stopping at will has been achieved. Under other circumstances starting and stopping has not been so successful.

Complete control of the gasifier cannot be achieved by manipulation of the fuel alone. The fuel must be regulated along with other parameters to achieve stable and smooth control.

is only slightly smaller than the stroke. The resulting bore to stroke ratios are 1.100, .956 and 1.043 from the smallest to the largest engine.

Cylinder Spacing

The cylinder spacing was determined prior to a detail analysis of the crankshaft. Cylinder barrels supported only by the top and bottom decks with adequate coolant space were necessary to meet foundry and engineering requirements. Cylinder head loads are carried through the outer water jacket walls to the main bearing bulkheads, eliminating barrel distortion, as illustrated by Fig. 1. Combustion load reactions were considered separately for each bank. The external longitudinal walls are the stress members which tie the cylinder heads to the transverse bulkhead walls containing the main bearing

Another prime consideration of cylinder spacing is the ability to seal the cylinder head. Finalization of combustion chamber design and relationship to the complete cylinder head was necessary to complete this phase. Six bolts per cylinder are used to clamp the head and transmit gas pressures to the outer jacket wall. It follows that basic proportions of ports and manifolds were simultaneously established.

Crankshaft

The crankshaft serves as a typical example of the approach used in the detail development necessary for a high output truck engine. Basic crankshaft length was fixed by the summation of the main and crank bearing lengths, the cheek widths, and the required fillets. Low numerical

fuels and lubricants.

Peak combustion pressures of 760 psi were used as a basic design parameter. The design parameters for engine operating conditions were peak torque at 2000 rpm, maximum power at 3500 rpm, and maximum speed, no load at 4500 rpm. A main bearing L/D ratio of .30 was selected to provide maximum bearing cooling and full area contact without localized edge loading. Design bearing pressures of 3500 psi for connecting rods and 2500 psi for main bearings have been used and proven to be satisfactory in this application. A firing order of 1-8-7-3-6-5-4-2 was selected. This permitted the lowest combined bearing loads with our crankshaft bearing spacing. A copper-lead-tin plated bearing material was selected for use with hardened journals.

Thrust is taken on the center main bearing. The other four bearings are interchangeable. The basic engine structure has sufficient backbone and bearing capacities to permit future utilization of improved fuels as they become available.

Stroke and Bore Proportions

Two bores and two strokes were used in producing this series of three engines. The bores selected are larger than the strokes of the V-401 and V-549 engines. In the V-461 the bore

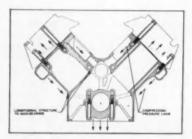


Fig. 1—Crankcase load distribution

values of bearing length to diameter ratios that provide large overlap in the cheek region were studied in relation to cheek thickness and fillet size. For this purpose, aluminum models as illustrated by Fig. 2 were used. These were subjected to stress-coat and strain-gauge techniques and results were reduced to portray equivalent values in steel. These data were applied to proportion a crankshaft having uniform stress and infinite life with a minimum use of material.

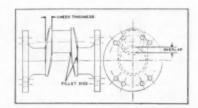


Fig. 2-Aluminum crankshaft model

As a further check, forged steel and heat treated samples of typical sections were fatigue tested for satisfactory endurance life. As a result, crankshafts are fabricated from C-1046 steel, induction hardened and weigh 96 pounds. The soundness of this approach to crankshaft analysis has been verified by extensive trouble-free laboratory and field endurance testing.

We elected to use a vibration damper on the V-549 and V-461 engines. The journal overlap resulting from common bearing diameters and reduced stroke in the V-401 engine increases torsional stiffness and elim-

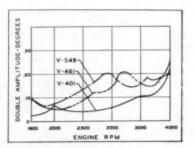


Fig. 3—Comparison of crankshaft

inates the need for a damper. The vibration characteristics of the three engines are shown in Fig. 3.

Connecting Rod

Detail tests similar to those described for the crankshaft were conducted on the connecting rod. Aluminum models were made of rod designs with variations in cap bolting methods. The final combination was selected with the self-locking type of capscrew to retain the rod cap.

The Regenerative Gas Turbine Engine for Firebird II

By W. A. Turunen and J. S. Collman GENERAL MOTORS RESEARCH STAFF

In designing the GT-304 engine, the overall power package was given prime consideration. Considerable thought was given to the design and location of each component in order to achieve a compact, well integrated assembly. A schematic engine arrangement is shown in accompanying cutaway drawing.

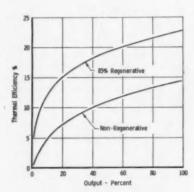


Fig. 1—Comparison of thermal efficiency of regenerative and non-regenerative cycles

Air enters the radial flow compressor from the left. After passing through the diffuser, it is diverted 90 deg and discharged axially into a plenum chamber housing the regenerators, combustion chambers and turbines. The plenum is divided into a high pressure and low pressure section by the seals and center bulkhead assembly. Two drum-shaped regenerators rotating about a horizontal axis pass from the low pressure or

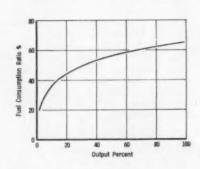


Fig. 2—Ratio of fuel consumption of regenerative and non-regenerative cycles

exhaust side of the plenum to the high pressure side through floating seals. The compressor discharge air passes radially through the regenerator drums picking up heat before entering the combustion chambers. The four, can-type combustion chambers, two on each side of the engine, are arranged parallel to the regenerator axis. Fuel is sprayed into the chambers through nozzles located in the outer ends of the cans. The heated gas leaving the chambers is diverted into the turbine inlet annulus by symmetrical transition sections.

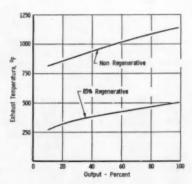
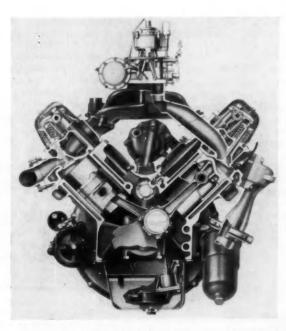


Fig. 3—Comparison of exhaust gas temperature of regenerative and nonregenerative cycles



Front sectional view of the International heavy-duty truck V-8 engine

The hot gas is expanded through two mechanically independent turbine stages located in the center cylinder. The first stage turbine drives the compressor and accessories, and the second stage turbine is connected to the vehicle wheels through reduction gears and the transmission. Hot gas exhausted from the power turbine is diverted into the center part of the low pressure plenum. From there the gas passes through the regenerator drum, to which it gives up heat. The heat transferred results in a considerable reduction in temperature before the gas is exhausted to the atmosphere.

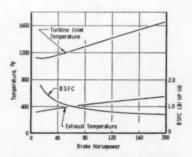


Fig. 4—Typical performance of GT-304 Whirlfire engine

One of the important features of this integrated engine arrangement is the direct air flow path and complete absence of interconnecting ducts. The minimum number of bends in the air flow path and large plenum type air passages contribute to very low pressure losses.

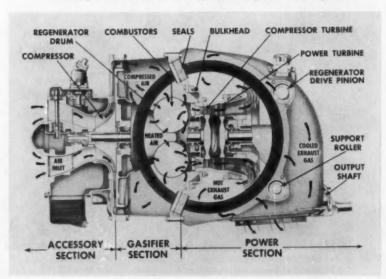
Another very important advantage

of the engine arrangement arises from the fact that those parts of the engine which are exposed to, or contain, the hot gases are confined within the inner diameter of the regenerator drums. The top, bottom, front and rear surfaces of the engine are exposed to compressor discharge air or exhaust gas cooled by passage through the regenerators. As a result, no thermal shielding or insulation is required for the engine except on the circular regenerator end covers. This reduction of heat loss from the engine minimizes engine compartment ventilation requirements and is undoubtedly reflected in at least a slightly higher thermal efficiency.

Regeneration

The addition of regeneration to the open cycle gas turbine can have a great effect on overall thermal efficiency. Regeneration also tends to reduce the optimum pressure ratio to a point well within the range of the radial flow compressor. This factor is highly desirable, especially where component simplification is important. In Fig. 1, the thermal efficiency of a non-regenerative cycle, with appropriate losses and efficiencies, operating at design point pressure ratio of 4.5:1 is compared with a typical regenerative cycle operating at 3.5:1 pressure ratio, 85 per cent regenerator effectiveness, and 5 per cent leakage. The regenerative cycle shows an efficiency margin of 8 percentage points from full load to very low output. The advantage of regeneration is more graphically demonstrated in Fig. 2. At full load the regenerative

Cutaway view of the GT-304 regenerative gas turbine engine



engine uses only 65 per cent of the fuel used by the non-regenerative engine while at 10 per cent load less than 40 per cent is required. This part load characteristic is especially attractive for automotive applications where the power plant operates most of the time at a small fraction of full power.

Another benefit of regeneration is reduction of the exhaust gas temperature. This is illustrated in Fig. 3, where the previous cycles are again used for comparison. The exhaust temperature of the regenerative cycle is about 600 F lower than the non-regenerative engine exhaust is about 550 F and at idle it is only about 250 F. This is a significant reduction in the amount of heat discharged to the

atmosphere and reflects the increased thermal efficiency of the regenerative design.

Engine Specifications

The design rating of the GT-304 engine is 200 horsepower at a gasifier speed of 35,000 rpm and turbine inlet temperature of 1650°F. Allowance is made for all engine accessories, inlet and exhaust losses and reduction gear losses. Rated power turbine speed is 28,000 rpm with an overspeed allowance to 35,000 rpm. A 7.27:1 three-step helical reduction gear reduces output shaft speed to a normal engine range.

The earlier models of the Whirlfire engines operated at 1500°F turbine inlet temperature with buckets made

of GMR-235, an alloy developed by the Metallurgy Department of Research Staff. Experience with these and other test engines indicated that higher turbine inlet temperatures could be used. On this basis, a design point turbine inlet temperature of 1650°F was chosen for the DT-304.

The weight of the original engine buildup is 850 lb. This weight can be reduced by further design refinements of the engine structure and components. The regenerators presently weigh approximately threefourths of a pound per horsepower.

Operating Experience

A limited amount of operating experience has been accumulated since the first model of the GT-304 engine

The Experimental Chassis for the Firebird II

By Joseph B. Bidwell and Robert E. Owen GENERAL MOTORS RESEARCH STAFF

THE Firebird II represents an interpretation of future trends in power plant and chassis design. It was conceived as a high speed, turbine powered vehicle to carry its four passengers comfortably for long distances on smooth highways. The specialized nature of its purpose dictated many of the design characteristics.

The gas turbine engine is located forward between the frame side rails

and front suspension arms. The propeller shaft is driven from the output of the power turbine through integral reduction gears. The three joint propeller shaft is enclosed in a narrow tunnel from which the center joint is supported. The transmission and final drive gears are mounted to the chassis behind the passenger compartment. All wheels are independently sprung and the rear wheels are driven by two

axle shafts from the transmission differential unit. The passenger space is located further forward relative to the wheels than in present cars. The short distance between the centerline of front wheels and the dash is possible as a result of the small tire diameter and the rear transmission position. This arrangement permits an almost

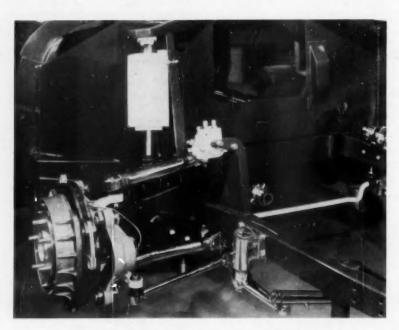


Fig. 1—Disk brake and right front suspension on the Firebird II

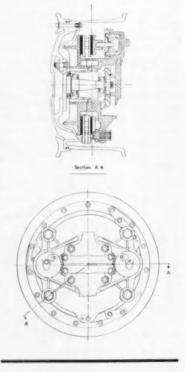


Fig. 2—Section through brake and wheel

was completed. This includes test cell operation as well as running experience in the Firebird II.

The close agreement of engine performance with design calculations has been very encouraging. Those problems which have come up are of such a nature that they can be resolved with our present engineering "knowhow."

The calculated performance data shown in Fig. 4 agrees closely with test results obtained to date. Leakage of the early regenerator seals was above the design limit and resulted in higher turbine inlet temperatures. This limited maximum output to 160 hp, or 80 per cent of design power. The latest seal design reduces this leakage to a value well below the initial design goal.

clear front compartment floor unobstructed by the usual transmission hump.

Brakes

Exceptional braking capacity is certainly one of the most important features required in a high speed car, especially in view of the lack of engine braking from the gas turbine power plant. The disk brakes with metallic linings and hydraulic booster used on the Firebird satisfy this need. These brakes were built by Moraine Products and are an adaptation of one of their designs. The compact hydraulic brake booster was made by Saginaw Steering Gear and provides a 3 to 1 boost ratio. Figs. 1 and 2 illustrate both the brake and wheel design. The wheel has a 16 inch rim with a separate flange. Elimination of the drop center makes a large diameter available for the brake. In this design, the iron brake disk with cored radial air passages is driven by three tangential links from pins in the wheel. This construction permits expansion of the disk without distortion of the wheel. The inner and outer aluminum brake structure is joined inside of the disk rather than outside, thus permitting a somewhat larger disk diameter. Two wheel cylinders are provided for each brake. Each actuates a separate set of metallic pads. The wheels are designed to circulate air over the disk and the central vanes in the disk circulate air and produce cooling from the center.

The extensive cooling provided coupled with the temperature resisting characteristic of the lining material and the absence of self actuation results in the desired fade resistance.

Springs

The springs utilized on the Firebird II were made by Delco Products and are shown schematically in section in Fig. 3. These units employ a fixed air mass as the spring medium. Oil is used to make up volume change of the air with load to maintain a constant car attitude. In this way, the need for an air pump is eliminated and the required power is supplied by the hydraulic system. A leveling system was considered essential in view of the limited total ride clearance.

The spring is designed so that air is retained between the outer shell and a cylindrical rubber diaphragm. The pressure is transmitted through oil to the top of a piston which supports the load. The oil passes through internal shock valving to get from the cylinder into the surrounding space. Thus, the oil in the unit is under pressure and aeration of the oil passing through the shock valves is prevented. Oil pressure at four passenger load is of the order of 750 psi. A separate leveling valve which senses suspension displacement permits oil to either enter or leave the spring as required. Leveling is only permitted at car speeds below 10 mph. The springs are locked out by transmission governor oil pressure which closes a cutout in the leveling valves at higher speeds.

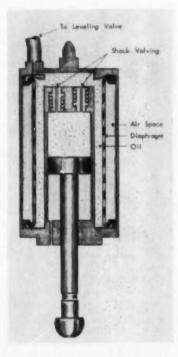
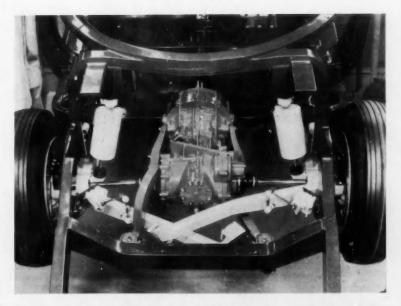


Fig. 3—Schematic of air-oil spring

Wheels and Tires

Wheels and tires for the Firebird II were designed to provide adequate space inside the rim for brakes and steering linkage and allow brake cooling without an excessively large over(Turn to page 100, please)



Rear view of General Motors Firebird II chassis, showing transmission, diagonal swing arm suspension, hydraulic leveling valves and air oil suspension units

Special Crane for Chassis Frames

A NEW method of automobile chassis frame unloading has been developed at the Framingham, Mass., plant of the Buick-Oldsmobile-Pontiac Assembly Division of General Motors.

The new method of unloading employs an Austin-Western crane with special attachments. Formerly, a standard crane was used, and the unloading process involved several "unavoidable waits" during the working cycle. The lost time resulted principally from the need to tie and untie the sling on the crane.

After considerable study, experimentation and consultation with equipment manufacturers, Framingham material handling personnel developed, with Austin-Western personnel, a one-man operation. The project was started in June, 1954.

The new method of chassis frame unloading calls for the operator to break down the dunnage in the cars to be unloaded and then to use the crane to unload all cars. No "waits" are required. The plant has determined through experiments that the operation is most efficient when six frames are picked up at one time. The 18-mile-an-hour speed of the crane offsets any

speed of the crane offsets any advantages a large quantity move might indicate.

The Austin-Western crane has four-wheel drive and four-wheel steering. The boom may be rotated 180 deg from the center of the crane, which permits



Six chassis frames are picked up simultaneously from a gondola by the special attachment on the Austin-Western crane



Frames are taken from a gondola car to a storage point outside the BOP plant; boom and attachment are hydravlically controlled

good operator visibility. The boom may be extended eight feet, controlled hydraulically from the cab. The end forks that pick up the chassis frames may be turned 270 deg and tilted about 15 deg, all controlled hydraulically from the cab.

GM Increases Ante For Scholarships

General Motors has added 200 scholarships to its higher education

program. They bring to more than \$5 million the amount the corporation will spend annually for that purpose.

Under the expanded program, 32

additional institutions will share in the grants from GM. Some 1600 students will benefit from the GM program on a continuing basis.

N excellent technical program featured the 40th Annual Meeting of the American Gear Manufacturers Association in Hot Springs, Va., last month. The gear rating committee sponsored a symposium on the coordinated rating for the strength of gear teeth with comments by the committee's chairman, E. J. Wellauer of Falk Corp., and committee members D. W. Dudley of GE and Wells Coleman of Gleason Works. R. W. Weber, Convair (San Diego) Div., of General Dynamics Corp., presented a paper on the present and projected airframe control gearing requirements. This presentation, sponsored by the aircraft gearing committee, D. W. Dudley of GE, chairman, will be given separate coverage in an early issue of AUTOMOTIVE INDUSTRIES.

The symposium was broken down into three parts: geometry factors and allowable stress; modifying factors used in AGMA strength ratings for gear teeth; and the method for estimating the fatigue life of bevel and hypoid gears. E. J. Wellauer led off the symposium by giving the basic equation, proposed by the committee, for the strength of gear teeth which is applicable to all types of gears. He indicated the derivation and application of the geometry and allowable stress factors applied to spur and helical teeth along with the principal modifying factors. Emphasis was placed on the ease with which the basic equation can be modified to incorporate, for more precise computations, information derived from tests, field experience, advanced analyses, or from a better understanding of gearing. He went on to say that the same reasoning applies to simplifications of factors of specialized design rating practices.

Four modifying factors-overload, size, load distribution, and dynamic-were discussed by D. W. Dudley during the second phase of the symposium. He told the group that the overload factor allows only for changes in torque that are of relatively instantaneous nature. These momentary torque changes, according to Mr. Dudley, occur in an interval of time corresponding to a few teeth going through mesh or at most, to an interval of time represented by the revolution of a gear. The overload factor allows for

By Thomas Mac New

roughness of operation rather than a change in transmitted power. Mr. Dudley pointed out that the overload factors for strength will probably pattern after those already in use for durability.

On the subject of gear size, Mr. Dudley stated that there is not much data at the present time which would permit estimating the size effect in gear tooth fatigue. He said, however, that the size effect is not large when dealing with conventional through-hardened gears.

Speaking on the load distribution factor, Mr. Dudley

40th Annual Meeting of AGMA

Coordinated Rating for the Strength of Gear Teeth Among Technical Subjects at Meeting of Gear Manufacturers

reported that when the face width of the pinion gets up around twice the pitch diameter, there is a strong effect from shaft deflection and twisting of the pinion on load distribution. Even if the teeth contact perfectly at no load, the elastic deflections of the pinion will tend to give a high load distribution factor. In low hardness gears where the twist and bending are extremely low, the effect of elastic deflections has been generally overlooked on the basis that field experience has been that the gears will wear in to compensate for the deflections. In the higher hardness gears, it has been found that the gears will not wear in to eliminate load distribution effects due to deflection.

Mr. Dudley pointed out that tests made over speed ranges from 2000 to 25,000 fpm show that there is no noticeable change in load carrying capacity with high precision gears and a favorable mass-elastic system. Test experience plus field experience of high speed gear sets have led to the use of a unity dynamic load factor. However, Mr. Dudley claims, this does not mean that there is no dynamic effect. He anticipates much progress in this direction in the years to come because of the current attention given dynamic load

by gear engineers.

The last portion of the symposium was handled by Wells Coleman who presented data for estimating the fatigue life of bevel and hypoid gears. Mr. Coleman's method of fatigue life determination offers a means for comparing various designs of bevel and hypoid gears. He included as many factors as possible in order to cover the large number of variables in gear design. He stated that only by using such an approach can comparisons be made between various tooth forms and gear mountings. The method could be simplified, according to Mr. Coleman, for the designer of commercial gears where large factors of safety are tolerated, but the simplification would be of little value for the most efficient use of materials.

In addition to the usual congratulatory remarks (Turn to page 120, please)



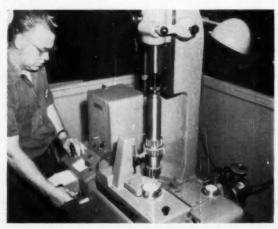
Looking into the work station of the versatile Modul AR Lo-Swing automatic lathe. The work piece in the rough and rough-turned condition may be seen in the foreground. Note the massive tool slides and tool holders which are responsible for rigidity and the ability to remove heavy cuts at high rates.

Fuller's Expanded Facilities

Road Ranger transmissions by the large fleet operators as well as an unprecedented demand for other types of heavy duty transmissions, Fuller Manufacturing Co. of Kalamazoo has become a phenomenon from the standpoint of growth. For one thing, the company is just completing its new expansion program involving two new plants on the outskirts of town. Although this expansion was calculated to solve the problem of stepped up requirements, the company finds the facilities inadequate for the currently enormous demand in the trucking field and is forced to consider a further increase in the size of the newly-built plants.

When we visited the new facilities recently we were impressed with the fact that the heart of the transmission—no matter what its size or type—is found in a complex of gears and shafting. We also learned that apart from load-carrying ability and endurance—so vital in heavy duty components—the modern heavy duty transmission must be quiet in the same sense as motor car drives are quiet. Quietness means even more in the trucking field where a skilled driver must stay at the wheel for an eight-hour stretch, where comfort and freedom from irritation make for safer hauling.

Quietness in a complex of gear trains imposes serious problems both in the design of components and in their manufacture. At Fuller each gear train is analyzed by gear specialists to determine the best design of gear elements for a given set of ratios. From this are developed the detailed specifications



View in gear laboratory showing the new Fellows involute checking machine fitted with the Red Liner attachment.

for machining, gear cutting, shaving, quality control, etc. As gear experts know, quiet gearing depends upon many variables that require control. It begins with specification steels at the mill; it includes the best forging practice; it demands exacting control of heat treatment.

Despite the large volume now in the picture, in terms of numbers it does not begin to compare with the quantities involved in motor car production. Moreover, there are so many models and variations that no matter how big the business becomes it still remains a glorified job lot operation. We mention this to show why an operation of this kind must continue to rely upon the more or less standard types of machine tools, including radial drills, lathes, and heavy duty single spindle drilling machines.

Because of the enormous variety of gears and shafts, this brief study touches primarily on a number of selected items of new equipment of advanced type employed in the manufacture of these parts. One example is the versatile and fully automatic Model AR Lo-Swing lathe, illustrated here. It is used for machining parts such as the clutch shaft with its integral drive gear from the rough forging. Although a number of stages of machining are required, the major steps—rough, and finish turning—are done in two operations, roughing being handled in the machine shown here at the rate of 27 pieces an hour. As shown, the lathe is equipped with massive tool blocks



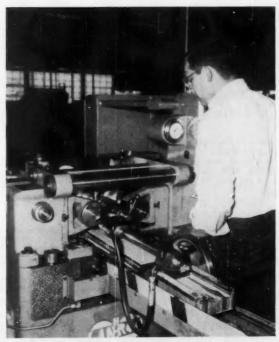
Perspective view of battery of heavy duty hydraulic type Barber-Colman hobbing machines.

for Heavy Duty Transmission Production

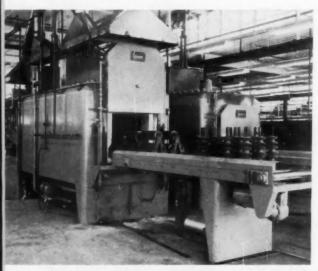
By Joseph Geschelin



Close-up of one of the new Fellows No. 4GS gear shapers installed in various departments. Above right—Landis Lanrol thread rolling machine. It is used for rolling the



thread on various shafts, requires only a matter of 15 seconds for producing a 2½ x 16 USF thread. The machine can produce other thread sizes.



Charging end of one of the new Ipsen gas carburizing furnaces. This view shows some of the variety of parts heat treated here as well as the method of loading on the conveyor.



Here is the new Cincinnati external grinder utilizing the sparkout principle. The Federal gage for autometic sizing is directly overhead and to the right of the wheelhead. Some of the variety of parts processed through this machine may be seen on the floor at the extreme right.

both front and rear, fitted with cemented-carbide tools.

It is of interest that despite the extremely heavy cuts taken on the roughing machine, the work is held securely by means of an air-operated expanding driver which grips within a core-drilled hole in the gear end. Another interesting point is that Cimcool cutting fluid is used in this machine as well as on a number of other lathes and heavy duty drilling machines.

Obviously it is necessary to have the best and most advanced gear cutting equipment available on the market today. In this connection Fuller has installed a number of the new Fellows No. 4GS gear shapers and a number of the larger Fellows No. 12 gear shapers, the latter being used in the older plant for producing much larger gears. The Fellows No. 4GS gear shaper, illustrated here, is busy producing countershaft shoulder gears. It is equipped with a special two-cut cam mechanism which makes it feasible to first rough the teeth, then shift automatically to resume the cycle and finish the teeth.

The gamut of flat gears of all sizes are cut in the impressive battery of eight of the latest type, hydraulically-operated, heavy duty Barber-Colman hobbers, known as Type 1415. It is of interest that all of these machines employ the climb cut principle.

In keeping with current practice all load-carrying gears are shaved in the green, sliding gears being crown-shaved. In the new plant, being described here, gear shaving is done in a large battery of the familiar Red Ring shavers.

The gear department has been provided with a gear laboratory, featuring two new pieces of equipment. One of these, illustrated here, is a Fellows involute checking machine fitted with a Red Liner attachment; the other is a Fellows lead checking machine also with a Red Liner attachment.

The clutch shaft that was mentioned earlier has a threaded section directly behind the drive gear. This thread— $2\frac{1}{8}$ x 16 USF, left hand with PD held to 2.0844—2.0804 in.—is cut by rolling in a matter of 15 seconds in the Landis Lanrol machine, illustrated here, using two thread rolls. The machine is provided with a variety of thread rolls to take care of other thread sizes.

As we mentioned earlier, quiet gear sets also require the most careful control of heat treatment. To effect this Fuller has developed an extremely compact heat treating department in the center of the plant. It consists of an installation of three, Ipsen Industries automatic, pusher type, gas carburizing furnaces, as illustrated. Each one is composed of two heating zones. The usual load is about 1200 lb, including the baskets, work being held in each zone for approximately three hours. Thus each load takes about six hours. However, at each three-hour interval a new load is moved into the first zone, thus providing for continuous operation.

As the cycle is completed, the load is moved automatically into the third section of the furnace where it is lowered by an elevator mechanism into an agitated oil quenching tank, where it is held for 15 minutes.

When 'this installation is fully completed it will have a wash and draw unit located alongside the third furnace. Each of the three furnaces then will connect by automation to a conveyor that will transport the baskets from a furnace directly into the washer. The entire cycle of events will be completely automatic in action

Exacting metallurgical control is impressed on the heat treating operation. Among other things, several

test pieces are wired into each basket and analyzed just as soon as the cycle is completed. These samples are flat ground in successive layers to check on the depth of carburization, hardness readings at each level, and core hardness.

All of the gears and shafts are processed through a new table type Wheelabrator for shot blasting as the final operation,

Another distinctive piece of new equipment is the fully automatic Cincinnati external grinder, illustrated here. Used for finish-grinding of the various shafts, it employs the sparkout principle for accurate control, and is fitted with a Federal electronic gage for automatic sizing.

Machining of cases is quite conventional, employing time tried procedures. From the standpoint of control the most important features are in the milling of faces in a large Kearney & Trecker milling machine and a Cincinnati mill. The various milled faces not only must be held accurately as to size but also as to flatness and squareness for alignment. Above all it is necessary to hold the shaft bores square with the milled ends and with accurate control of spacing and centers. The latter operation is performed in a double-end Heald Model 46B precision boring machine having two spindles at each end, holding centers to a tolerance of 0.002 in. The quills carry intricate combination tools that move in progressively to rough- and finish-bore, then counterbore.

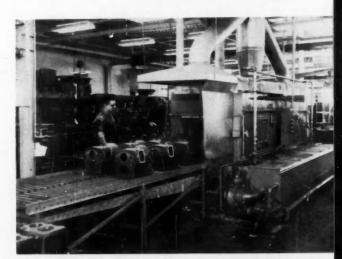
Transmission cases are washed in a new Solventol unit. This machine is fully automatic, equipped with a power-driven conveyor, and uses a multiplicity of high pressure jets from all directions to assure cleanness.

It is noteworthy that all parts are inspected at each stage of operation to assure precise quality control.

Transmissions are assembled in an adjacent department. Immediately after assembly each transmission is transported to a dynamometer test stand where it is filled with lubricant, then put through its operational phases while driven under power. Besides noting shift behavior the operator watches closely to assure freedom from noise in any maneuver.



Transmission cases are bored, one end at a time, in this double-end Heald Model 46B precision boring machine. Each end is provided with two spindles. Centers are held to a tolerance of 0.002 in.



Here is a perspective of the new Solventol washing machine installed in the transmission case department

Several Air Force Contracts Are Awarded to Four Concerns

Air Force contracts totaling more than \$27 million have been awarded to four companies. The largest, amounting to \$11.8 million, went to Lockheed Aircraft Services Overseas, Inc., to aid a Japanese company build T-33 trainers.

Other awards include: American Bosch Arma Corp., \$8 million for fire control systems; Radio Corp. of America, \$6.3 million for power supply radio set controls; and International Business Machines Corp., \$1.2 million for services in conjunction with bombing navigational computer equipment.

Rockwell Launches Expansion Of Its Delta Power Tool Div.

Rockwell Manufacturing Co. in planning to expand its Delta Power Tool Div. in view of an expected increase in sales this year. Expansion at the Tupelo, Miss., and Bellefontaine, Ohio, plants will increase total manufacturing facilities of the division by 70 per cent and bring total space to more than 500,000 sq ft.

Automobile Door Latches Hailed as Safety Factor

How many deaths and injuries safety door latches on automobiles may have prevented probably will never be known. However, the merits of new door locks developed by car manufacturers continue to be cited by safety experts. They point to studies which show that opening of doors and ejection of occupants are the most important factors influencing injury in non-rollover automobile accidents. Wisely, manufacturers are increasingly safety-conscious in car design.

1956 Material Handling Exposition

By Charles A. Weinert

OLORFUL and expansive, the 1956 Exposition of The Material Handling Institute, held in Cleveland last month, drew an attendance of some 25,000 visitors. The show, devoted exclusively to material handling equipment, represented participation of 150 manufacturers who displayed over 1200 new products and developments having an estimated value of more than \$4.5 million. The American Material Handling Society sponsored 12 technical sessions, held concurrently with the Exposition, at which specialists discussed various aspects of material handling. Among the subjects were plant layout, work simplification, cost analysis, work measurement, traffic management, automation, distribution and storage.

EXHIBIT

The Exposition included multi-displays of industrial trucks, conveyor systems, loading ramps, cranes and hoists, industrial containers, strapping equipment, etc. A number of these new developments were described in a preview of the show which appeared in Automotive Industries, June 1, pages 79-83 and 98. Illustrative of additional items of equipment which were exhibited are the following.

CONVEYOR SYSTEM

A model of a power and free conveyor system, incorporating provision for overhead live storage in a production line setup, was displayed by Jervis B. Webb Co. By thus utilizing overhead areas of buildings, floor area is conserved and expansion is possible without building additional space. A master panel controls the conveyor system operation, and rate of travel and feed speeds may be varied to suit production needs.

CLOSED CIRCUIT TV

Closed circuit TV systems were proposed by General Electric Co. and shown in actual operation at the exposition. Possible industrial plant applications include worker supervision of plant processes where close proximity would cause bodily harm.

INDUSTRIAL TRUCKS

A new side stacker electric truck, of 3000 lb capacity, was introduced by Moto-Truc Co. It is only five feet wide by 68 in. long.

While featuring the new Clarklift Line of fork lift trucks, Clark Equipment Co. also showed for the first time the Series 71, 10,000-lb and the Series 93, 30,000-lb straddle carriers; and the YL-150 and YL-350 fork trucks designed for heavy outdoor work, having capacities of 15,000 and 35,000 lb respectively.

Whiting Corp. displayed for the first time the Trackmobile, a unit for switching and spotting freight cars when using its flanged track wheels, and for pulling wheeled shop trailers, carts and skids when operated on its rubber-tired road wheels.

ELECTRONIC CRANE CONTROL

Using gas-filled tubes in an electronic control circuit, a stepless control for overhead electric traveling cranes was shown by Harnischfeger Corp. Applied in conjunction with the company's Magnetorque, the control is said to give an infinite number of speed variations, providing precise control and spotting in both lowering and hoisting directions.

STRAPPING MACHINE

In operation was a semi-automatic strapping machine, strapping boxes at high speed as they moved in a continuous flow over a special production line conveyor setup. Called the Model F1 and offered by Acme Steel Products Div., it is electrically powered and controlled. Upon operation of the cycle bar the machine automatically tensions and cuts the strapping, and joins the overlapped ends with two spot welds.

PERSONNEL CARRIER

An intra-plant personnel carrier, called the Runabout, was the feature attraction of the Kalamazoo Manufacturing Co. booth. It is a single seater unit, driven by a 6/12-v electric motor with enclosed reduction gear, final drive being by vee belt to the front wheel. Equipment includes two 6-v batteries, with a built-in charger. The vehicle can also pull 500-lb trailer loads.

TRUCKS AND ATTACHMENTS

In addition to new gasoline fork lift models, a new 4000 and 6000-lb capacity rider-walkie pallet truck and a new 4000-lb short sit-down electric truck were introduced by Yale & Towne Manufacturing Co.

Of unusual interest was a unique horizontally rotating die-handler which allows dies to be loaded or unloaded from inclined presses from any angle of approach. As demonstrated at the exposition, the new die handling attachment was mounted on an Automatic Transportation Co. Model LFS-90 heavy duty electric driven truck. It can handle dies up to 6000 lb, and the die handler, which works off the truck's hydraulic system, is controlled by a portable pushbutton panel. Also shown was the new Schmidgall attachment, designed to handle patterned loads of different size cartons without pallets.

A new line of electric powered, heavy duty ram trucks, with capacities from 20,000 to 80,000 lb, was announced at the show by Elwell-Parker Electric Co.

SELF-PROPELLED CRANE

Austin-Western Works showed a self-propelled hydraulic crane with a telescoping boom which can be raised from horizontal to an approximate 45 deg angle, or any intermediate point, and is continuously rotatable through 360 deg.

IN-PROCESS WEIGHING

Electrical weighing of materials while moving in industrial production lines or processes was demontrated on a fork truck in the Electronics and Instrumentation Div., Baldwin-Lima-Hamilton Corp. booth. The weight transducers incorporate SR-4 resistance wire strain gages as sensing devices which respond to loads by changes in resistance to flow of small electric currents. These changes are detected by electrical instruments which convert the signals to an appropriate unit of weight. In some applications the weight signals are used to trigger automatic controls in the processing of the materials handled.

LOADING RAMP

A new 40-foot sectional loading ramp was offered by Magline Inc. It is constructed of magnesium, and can be erected, disassembled and transported by fork truck with one man handling the entire operation. The ramp is comprised of four 10-ft sections, which, when locked together, form a smooth runway from the ground to the freight car or loading dock.

CASTERS

Albion Industries, Inc., announced a series of sealed casters that incorporate precision molded ring seals around the load raceways as well as the wheel axle ends, and a formed steel, leakproof retainer cup pressfitted over the thrust raceway for additional grease retaining qualities. Also featured were demountable-tire caster wheels which permit tire replacement by removal of four bolts.

AUTOMATED CARRIER

An automated bucket carrier conveyor system for blenders, grinding mills and tumbling barrels was shown for the first time by Hapman Conveyors, Inc. Parts and finishing abrasives are automatically fed to processing units; and after processing are carried to a vibrating screen or magnetic separator, from which finished parts are removed and abrasives returned to buckets for re-use.

LOAD LUGGER

Ingersoll Kalamazoo Div., Borg-Warner Corp. made an initial showing of the Model CH-600 Load Lugger, an 18-000-lb payload unit for mounting on a motor truck chassis, which has a boist mechanism for handling the carrying of materials in separate containers.

LIVE-STORAGE RACKS

Wheel type racks for live storage and feeding of boxed or palletized loads of parts in production lines was included in the Alvey-Ferguson Co. exhibit.

HYDRAULICS DISPLAY

Vickers, Inc., had an impressive display, including animated models of its hydraulic components and systems as applied to many of the end products being exhibited by various makers.

AUTOMATIC DOCKBOARDS

A new series of Hi-Lo automatic dockboards, in which the operating arms are actuated by the truck in adjusting the dockboard to meet carrier bed levels, was introduced by Kelley Co., Inc. There are no power or control requirements required.

ALL-HYDRAULIC TRUCKS

Hydrostatic drive industrial trucks were shown by the Colson Corp. The units, which consist of 2000 and 4000-lb narrow aisle tiering trucks, 4000-lb pallet and platform transporting trucks, and 1000-lb fork lifters, have a dual fixed displacement gear pump driven by an engine, in combination with a three-plunger control valve and a hydraulic gear-type drive motor. The control valve directs oil to provide low and high speeds in each direction, and has a neutral point where the oil is locked on both sides of the motor, thus providing braking to the drive wheel as the control lever is brought to the neutral position.

TECHNICAL SESSIONS

PLANT LAYOUT

During the various technical sessions of the Society the speakers' remarks were directed to improving the efficiency of material handling operations. Pointing out that material handling cannot be properly integrated into plant layout unless it is designed in from the start, James M. Apple of Michigan State University urged that the plant layout be built around a well-planned material handling flow pattern; rather than the converse as is sometimes done. He outlined a 15-step program as a guide for planning the interrelationship between material handling and plant layout.

(Turn to page 118, please)



AUTOMATIC CONTROLS
PRODUCTION — VEHICLES — AIRCRAFT

By Samuel Cummings

ALL-PURPOSE COMPUTER

Bendix Computer Div. has combined its general purpose digital computer with a digital differential analyzer to make up what it calls an all-purpose computer. The combined product makes use of the simple programming procedures of differential analyzers for the solution of linear and nonlinear differential equations. Because of the flexible programming, it has been possible to devise a library of specialized routines to enable personnel without computer experience to prepare problems. An electric typewriter controls all computer operations-it may be used to enter information directly into the computer as well as to tabulate the output of the machine. Input or output operation for as many as 108 words can be initiated by a single command, and without interrupting computing activity. Four magnetic tape units-each capable of storing 300,000 words-a graph plotter, follower, etc., are available as auxiliary equipment.

SUMMER COURSE

For anyone interested in obtaining some training in computer techniques, Wayne University is offering three one-week courses this summer, complete with computing and data processing machines. Students will be encouraged to run problems they have prepared, during workshop periods, on the laboratory's Burroughs UDEC and IBM 650. On hand also, to serve as laboratory equipment, will be the Bendix G 15, the Burroughs E 101, and Remington Rand's Uniservos and Uniprinters. Courses run from July 23 to Aug. 11. For further information, write to A. W. Jacobson, Wayne University, Computation Laboratory, Detroit 1, Michigan.

BABY UNIVAC

Remington Rand has come up with something truly ingenious in the digital computer field—a midget general purpose UNIVAC that takes up only 250 sq ft and is just as versatile as its big brother. The com-

puter section of the baby UNIVAC is housed in a compact cabinet six feet high, six feet, six inches long, and 18 in. deep. The operating console, which includes paper tape, input-output unit, and direct entry typewriter, is a trim four by six by three feet.

This scaled-down version of UNIVAC has been made possible by the use of tiny pulse-amplifying devices, called Ferractors, which were developed by Remington Rand engineers as a reliable substitute for the vacuum tubes of conventional computers. Another space saver is a five by three inch magnetic memory drum, which revolves at a speed of 16,500 rpm and stores magnetic impulses imprinted by "writing heads," set 0.001 in. off the drum's nickel-cobalt surface.

The Ferractor itself consists of a tiny ring of metal, roughly spool shaped with another strip of metal set around its outer circumference; and around the whole is wrapped fine, insulated wire. Two Ferractors, each replacing a conventional vacuum tube, are sealed within a casing. Four of these casings are mounted on a thin plastic card, along with resistors, diodes, and tiny electronic fittings. About 600 of these cards, plus a few conventional transistors and the high-speed magnetic drum, make up the main working portion of the computer.

The new machine can add two 10 digit numbers in 90 microsec, or more than 11,000 additions per second; and can multiply in from 0.3 to 1.7 millisec, or over 3000 multiplications per second. It was designed and built for the Air Force, and the first model will go to the Air Force Cambridge Research Center, at Bedford, Mass., where it will be assigned to classified military projects. There is no word from Remington Rand as to when the new computer will be available for the commercial market.

LOW-COST BRAIN

Rumors of new electronic wonders fill the air. Following the announcement of Remington Rand's baby UNIVAC comes word of another electronic brain that is claimed to have the capabilities of the giant million dollar variety but that costs only about one eighth as much.

Logistics Research, Inc., has divulged a few details about the ALWAC 800, a high-speed data processing system, which it estimates will sell for \$125,000. The new machine uses 12 decimal digit numbers, and is capable of 11,000 additions, 2000 multiplications, or 13,000 comparisons per second. ALWAC's high-speed internal memory unit may be supplemented, its makers say, with as many as 10 magnetic drum storage units, each having a 12-million decimal digit capacity. Input-output consists of punched cards, line printer, high-speed paper tape, and electric typewriter. Because it is designed on the modular or building block principle, ALWAC can be expanded to meet the user's changing data process requirements. Deliveries, according to Logistics Research officials, are scheduled in from 12 to 18 months.

SCHWITZER VIBRATION DAMPER



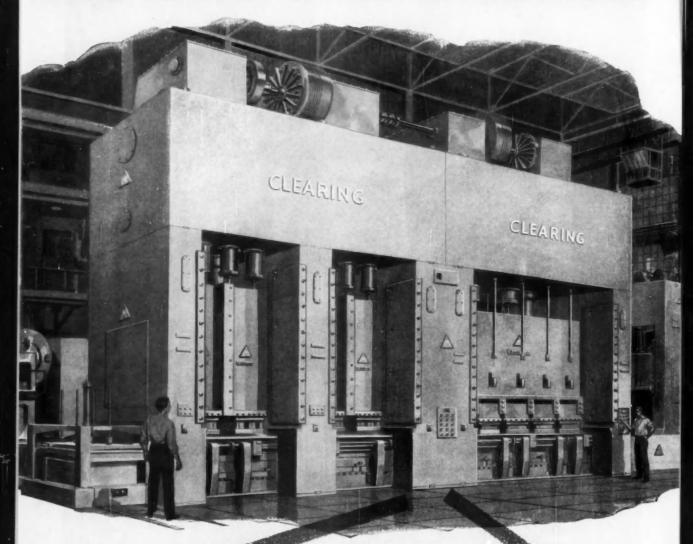
MILLIONS OF AUTOMOTIVE, TRUCK AND HEAVY DUTY ENGINES

tions, minimize torsional vibrations • Schwitzer originated and developed this Dampers • Precision controlled elastic members, tailored to individual applicarugged, simplified Damper—another advancement in smoothness and economy. Operate smoother, longer and with less maintenance with Schwitzer

Schwitzer assures you of advanced design and economy in Fluid Flow and Vibration Damping Products.

SCHWITZER CORPORATION . INDIANAPOLIS 7, INDIANA

CLEARING announces



Here's a veritable monster of
a press (58 feet from end to end) that
can never become a white elephant. It is built
on the new Clearing MODULAR principle. As your
requirements for stamping stations change, you modify the
very structure of the press to suit the changed conditions.



MODULAR CONSTRUCTION

Two Drive

Two Beds

Two Crowns

Common Uprights

(Serve both crowns and beds)



SPLIT SLIDES

make instant die changes possible



MULTIPLE SLIDES

provide for differential loading

Transflex Feed Mechanism for automatic feeding—hands-off production



SUB-SLIDES

for individual die adjustment and die changes

MODULAR Presses

the TRANSFLEX
equipment you can
modify for major
production
changes

The Modular Principle

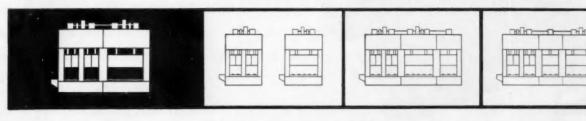
Here is how Clearing modular construction overcomes the historic drawback which heretofore would have made equipment of this nature impractical. Modular press construction is a Clearing innovation that makes it entirely practical to automate the production of large scale parts without fear that future changes in models will render the press equipment obsolescent. The illustration at left shows a Transflex press designed for the General Electric Company to produce two similar parts alternately—without requiring an actual die change.

In order to obtain the most ideal production set up, a number of Transflex principles were applied ... multiple slides, split slides, the versatile Transflex feed mechanism . . . and a giant press 58 feet in length began to take shape. By turning to modular construction a complex press of this size became practical. Two crowns are used with two separate drives mechanically interlocked. There are five slides, four uprights, and two beds. All of these parts add up to one automatic machine designed for today's type of production. However, if future model changes radically alter the number of operations required or the tonnage characteristics of the series, the investment in automation equipment will not have become obsolete. Modular frame elements can be added to or subtracted from the structure and the versatile transflex feed mechanism can be lengthened or shortened to recreate an automatic press which will meet tomorrow's production needs.

A schematic drawing of the press as it was designed for the General Electric Company to produce washing machine and dryer covers in a dual tooling set up.

As requirements change the modular press can be converted to two separate presses, or . . . additional modular units may be added to one end of the machine to increase the number of available stations, or . . .

additional modular units may be placed in the center to after the sequence of tonnage capacities,



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CLEARING PRESSES THE WAY TO EFFICIENT MASS PRODUCTION

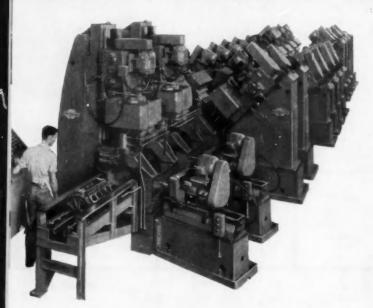
CLEARING MACHINE CORPORATION . Division of U.S. INDUSTRIES, INC.

6499 W. 65th Street, Chicago 38, Illinois • Hamilton Plant, Hamilton, Ohio





NOW...BIGGER TO SERVE YOU BETTER



This 17-Station Greenlee Transfer Machine, the first in a line of three ... carries 152 tools. It automatically drills, countersinks, cleans and gauges holes in V-8 cylinder blocks. Take advantage of Greenlee's specialized assistance in planning for automatic production. Write or wire today for a consultation.

New, Enlarged Production Facilities Speed Delivery of Greenlee TRANSFER MACHINES

Pictured is one of four Greenlee assembly floors. This newly constructed, block-long building covers almost two acres of ground . . . provides a well-lighted, roomy area for erecting and testing Greenlee Transfer Machines similar to the ones illustrated.



GREENLEE BROS. & CO. 1757 Mason Avenue Rockford, Illinois



Last Longer make Valves Last Longer

For engines in heavy-duty service where high operating temperatures are experienced over extended periods of time, Eaton Valve Seat Inserts have proven their ability to materially reduce valve and insert failures, to maintain a high level of engine output—and to add extra thousands of trouble-free hours to valve life.

Eaton engineers will be glad to discuss the application of Eatonite Valve Seat Inserts with your engineering and metallurgical departments.

MAXIMUM DURABILITY

High Hot Strength

High Hot Hardness

Freedom from Corrosion, Wear, Cracking, Loosening

EATON

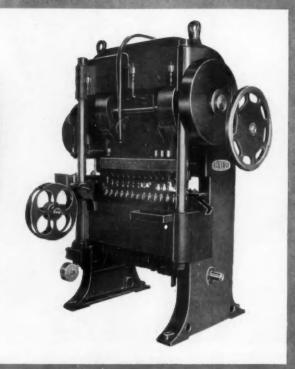
MANUFACTURING COMPANY
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PRODUCTS: Sodium Cooled, Poppet, and Free Valves • Tappets • Hydraulic Valve Lifters • Valve Seat Inserts • Jet Engine Parts • Rotor Pumps • Motor Truck Axles • Permanent Mold Gray Iron Castings • Heater Defroster Units • Snap Rings Springtites • Spring Washers • Cold Drawn Steel • Stampings • Leaf and Coil Springs • Dynamatic Drives, Brakes, Dynamometers

...ask BARD about it



A complete die set with full complement of punches and dies in working position and with transter in loading position. Note accessibility of all mechanisms and adjustments.



What is so different about BAIRD Multiple Transfer Presses

Many still confuse these advanced high production machines with multiple-slide presses (commonly called eyelet machines) or with equipment using progressive dies.

They are, in fact, entirely different . . . and the advantages of Baird design result in much more flexible and versatile tooling . . . much less down-time for initial tooling, maintenance and change-over . . . use of minimum width stock . . . maximum production speeds smoothly maintained.

In addition, Baird Multiple Transfer Presses can maintain closer tolerances than previous methods on high production of parts requiring from 8 to 15 consecutive operations.

So smoothly do these machines operate that old-time press-room clatter is a thing of the past. Normally, long production runs at high speed may be maintained without adjustment down-time.

If you are looking for the most modern equipment available for volume production of press-produced parts . . . by all means "ask Baird about it." Our development of the Baird Automatic Multiple Transfer Press has set many new standards in this field. Write Dept. Al.

AUTOMATIC MACHINE TOOLS . AUTOMATIC WIRE & RIBBON METAL

THE BAIRD MACHINE COMPANY
STRATFORD CONNECTICUT

28A56

News of the MACHINERY INDUSTRIES

By Thomas Mac New

Huge Cold Forging Machine, Now Under Construction, Will Produce Five-Lb Cap Screws, High-Speed Turning of Shafts Achieved by Use of Cemented Oxide

Cold-Forged **Five Pound Screws**

National Machinery Co. is building the largest Boltmaker cold-forging machine for the new Cleveland Cap Screw Co. plant in Cleveland. The machine, a 196 ton unit, will draw raw stock of 17/16 in. hot-rolled steel rod to produce 11/4 in. diam by 10 in. long cap screws at a 40 per minute clip. These screws will weigh about five pounds apiece and are probably the largest product made by the coldforging technique. Cleveland Cap is paying something over \$400,000 for the new machine.

Low Price Grinder Hits Market

Automotive Industries' reporters relate that Joseph T. Vinbury, general sales manager of Abrasive Machine Toel Co., East Providence, R. I., held a well organized and highly successful press conference to announce a new surface grinder. The grinder, called the Six Eighteen, is described in detail in the New Plant and Production Equipment section of this issue. Big news about the machine is the price-the seven-inch wheel model sells for \$1950 while the 12-in. wheel model goes for \$1985 both fob Providence. Mr. Vinbury stated that this is just the first of a series of grinding machines by Abrasive which will be new in design, new in styling, and low in price.

Handling Developments

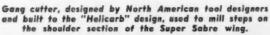
Five new developments in European materials handling equipment were described and illustrated with

color slides by Hans W. von der Recke, Sales Engineer, Hewitt-Robins Inc., at the semi-annual meeting of the American Society of Mechanical Engineers in Cleveland last month. They are:

- 1. Use of a steel bar chain or wire rope to impart forward motion to belt conveyors, permitting the use of inexpensive rubber belting for spans of almost unlimited length.
- 2. Suspending conveyor belts from a monorail or a wire rope across valleys or rivers and handling loads on both the forward and return strands at the same time.
- 3. Novel methods of using cleats on belt conveyors to carry material at inclines as steep as 65 deg.
- 4. Use of linked aprons to go around horizontal curves with a half radius as small as 20 ft to follow curving coal seams with continuous conveyors.
- 5. "Box and shell" construction of dock cranes which are 50 per cent lighter and take far less quayside than conventional cranes of the same carrying capacity. (Cont. next page)



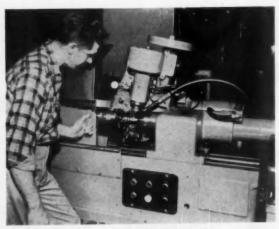




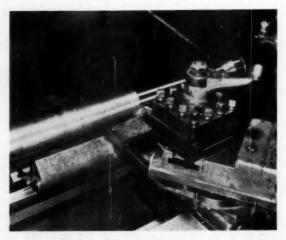




AUTOMOTIVE INDUSTRIES, July 1, 1956



Hobbing steering gear sectors for power steering units at Chrysler's Trenton, Mich., plant. Machine being used is a modified Model 1458 hobber built by Michigan Tool Co. Collet type aligning fixture positively positions part despite variations in torgings.



Closeup of finish turning operation at R. K. LeBiond showing new Carboloy grade 0-30 cemented oxide tool cutting at 715 fpm. Twelve-step finish turning time on each spindle was reduced from six to 2.8 min.

These and other designs were photographed by Mr. von der Recke, mostly in Germany. He said that some of the developments are still in the experimental stage. Mr. von der Recke placed special emphasis on attempts to transmit power for belt conveyors through wire rope, around link chains and similar materials rather than through the belts themselves.

Hobbing Triples Rate

Michigan Tool's "Ultra-Speed" hobber plays a big role in producing a power steering component-the gear sector-for Chrysler Corp. Since the part being hobbed is a sector and not a full gear, the hobber must have a high degree of rigidity to withstand the shock imposed when the hob bites into metal after running free for a portion of each revolution. A modified model 1458 Michigan hobber feeds the hob across the work by means of a hydraulic cylinder mounted on the main head section. In addition, the hob is fed at an angle to the axis of the part to produce the tapered teeth required.

To insure maximum production of satisfactory parts, the job depends to a considerable degree on positioning the forgings properly for the hobbing operation. To overcome the effect of forging variations and to hold the part securely during machining, Michigan tool-engineers devaloped a collet type holding and aligning fixture. A hydraulically-

actuated tailstock maintains pressure on the part during the hobbing operation. This pressure also operates the collet type clamping fixture. Hourly production rate realized is 45 hobbed steering gear sectors per hour, three times the previous output per machine. A total is 110 parts are produced per hob sharpening by shifting the hob four times.

Machine Tool Orders Ahead of '55 by 60 Pct.

Although orders for machine tools in April declined by more than 12 per cent under March, total business for the first four months climbed by 60 per cent ahead of last year to approximately \$380 million. The April total was still a whopping 59 per cent ahead of the same month last year. Indications are that May orders will show an upswing again, with some companies reporting business slightly ahead of the two previous months. Shipments during the first four months did not keep pace with orders, climbing only 25 per cent ahead of last year. However, April shipments rose by 34 per cent above the same month in 1955.

AUTOMOTIVE INDUSTRIES . . .

is your News Magazine of Automotive and Aviation MANUFACTURING

LeBlond Turns Spindles Faster

Stepped-up machine speeds through the use of cemented oxide- Carboloy 0-30-in finish turning 31-in. long lathe spindles recently enabled R. K. LeBlond Machine Tool Co., Cincinnati. to improve work finishes and increase production over 100 per cent. The time cycle for all steps required to finish each spindle-minus loading time-was reduced to 2.8 min under actual production conditions. Work is being turned at 715 sfm. The job at LeBlond calls for making a 12-step cut with only one cutting tool along 29 in. of the 31-in. spindle. The latter is 31/2 in. diam stepped down to 2% in. at one end. Application of the new cemented oxide tool with proper geometries has boosted the machine output to 29 spindles before tool resharpening. Size variation between spindles in each run of 29 varies only about 0.001-in. without touching the setup.

Titanium Carbide Study

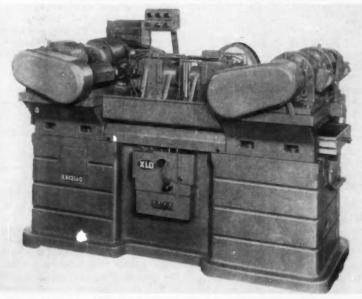
The effects of raw material production variables on the physical and chemical properties of titanium carbide are described in a report—PB 111989—of research for the Air Force just released to industry through the Office of Technical Services, U. S. Department of Commerce. Various titanium carbides produced commercially by as many different procedures were used.



PRODUCTION EQUIPMENT

FOR ADDITIONAL INFORMATION, please use reply card on PAGE 89

Boring Machine Mills Parts at High Rate



This Style 17-A double-end precision boring machine is arranged to mill two parts pe cycle in continuous operation. Machining operations consist of facing and undercutting with milling cutters a propeller shaft pinion flange at two places. The machine is a basic unit with extra-wide bridges for transverse mounting of the spindles. It is arranged for both atto extra-wide prages for transverse mounting of the spinates. It is arranged for both automatic and manually-controlled operation. One part is loaded as a second part is being machined, resulting in a production rate of 188 parts per hour. The workpiece is held in position by pushbutton operated hydraulic clamps. Safety devices prevent operation of the machine it a part is improperly loaded or clamped. (Ex-Cell-O Corp.)

Circle 30 on postcard for more data

Fluid Motor Combination

Now available is a speed control, fluid motor, speed reducer combination which combines a slow output rpm with torque multiplication. The fluid motor is equipped with a builtin relief valve for allowing maximum torque input to the speed reducer and to prevent overloading. Typical of its uses are for conveyor drives where variable speed is required, or other applications requiring variable speed and relatively low hp output and feeding attachments.

The fluid motor is built and can be furnished with or without a speed control valve. Speed reducers are available in a range of ratios, with speed control valves to handle 0 to 2, 0 to 4 and 0 to 6 gpm. The fluid motors

have gear widths of 1/2, 3/4, or 1 in. John S. Barnes Corp.

Circle 31 on postcard for more data



Barnes low-speed fluid motor combination

Small Dynamometer

For research and development, production testing and maintenance of motors, generators, fans, pumps, etc., a fractional - horsepower dynamometer, designated the Model 1100, has been announced. It can be used to obtain performance curves on small motors and generators; check power requirements of small fans, pumps and compressors; and to test fractionalhorsepower internal combustion en-

The Model 1100 is a d-c unit, separately excited, suitable for operation



Standard Model 1100 dynamometer

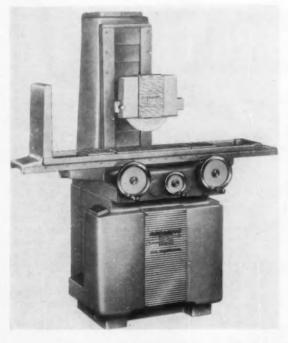
from a 125-v power source. The base of the equipment has longitudinal slots (parallel to the shaft of the motor) so that varying size motors or mechanical units may be used.

Included as part of the control panel are an armature ammeter, armature voltmeter, "low-off-high" load switch and a field rheostat. Two screw-base type resistor units (660-w each) are located on the subbase for loading the dynamometer as a generator. Larger resistor units can be used. The 10-in. diam Chatillon scale is pre-loaded to allow torque readings in either direction of rotation. A direct reading tachometer is available as an accessory.

The Model 1100, as a motor, is rated at % hp at 2500 rpm. As a generator, absorption is 1 hp continuous. The Standard Electric Time Co.

Circle 32 on postcard for more data

PRODUCTION EQUIPMENT



Abrasive No. 618 surface grinder features roller - bearing saddle with anti-backlash, cable and drum table drive, fully enclosed, dynamically - balanced cartridge - type spindle and smooth lines, in a new design

Precision Surface Grinder of New Design

Designated the No. 618, an entirely new surface grinder has been unveiled highlighting new size, design and features. The size, 6 by 18 by 12-in., is said to be in keeping with the current demand for a small, yet rugged, precision grinder that is easy to operate and maintain. To provide positive grinding control, new roller-bearing ways, a backlash eliminator on the saddle feed and a unique table cable and drum drive have been incorporated in the design. All controls are on the same waist-high plane.

The saddle is a close-grain, stress-relieved casting. Full five in. depth of saddle box construction is said to prevent distortion or warping even at 50 pct overload. The spindle is of wide diameter cartridge design and is totally enclosed, dynamically balanced and lifetime lubricated. The machine is equipped with either a 12-in. grinding wheel powered by a 2 hp, 1750 rpm motor, or a 7-in. grinding wheel with a 1 hp 3450 rpm motor. Abrasive Machine Tool Co.

Circle 33 on postcard for more data

Resin Proportional-Metering Equipment

Several series of equipment designs are said to be now available for continuous proportional metering of resins (including abrasive fillers) and hardeners with component viscosities up to one million cps at ambient temperatures, or for special application at elevated temperatures. They are adjustable for a range of ratios and can be used with two or more components. Epoxies, polyesters, polyurethanes, polysulphides and polyamides are some of the reactive resin mixes automatically handled by these proportional metering, mixing and metered dispensing systems.

The basic design uses a positive acting hydraulic escapement mechanism with double feed-back control which is stated to give accuracies greater than ±0.5 per cent of any one component. Each increment of material flowing through the system is maintained in the required ratio by the simultaneous and continuous proportional metering of all components. This condition is said to allow the usage of "flow-through" mixer-reactor designs of 5 to 10 cc net volume with mixing capacities to four liters per minute. Units are available with greater mixing capacities.

Metered mix discharge can reportedly meet production demands up to 100 shots per minute. Discharge pressures to 3000 psi are obtainable. Applied Engineering Associates.

Circle 34 on postcard for more data

Plating Additive

Designated CPA 1800, a chromium plating additive has been designed for both decorative and hard-chrome plating applications. The new catalyst, in replacing a portion of the sulfate used in conventional chrome-plating solutions, is reported to speed up and simplify operations. It is also claimed to make possible the electrodeposition of brighter and harder coatings, to provide a broader range of plating solution and greater covering power, and to improve the metallurgical characteristics of the chromium plate. Diamond Alkali Co.

Circle 35 on postcard for more data

Combustion Tube Furnace

THE Model CF-4SA, four kw electric resistance element furnace, accommodating one combustion tube up to five in. OD, with a maximum furnace temperature of 2750 F, is being offered. Heat is supplied by eight silicon-carbide heating elements having an effective heating length of eight in.

The large size tube allows use of the furnace for production runs of small parts and it is available with water jacketed Inconel tube assembly for heat treating applications up to 2150 F requiring a protective atmosphere. Such applications include the bright annealing of metals and al-



Lindberg Type CF-4SA combustion tube furnace

loys including high carbon steel and stainless steel; bright brazing of metals and alloys; bright heat treatment of metals; and the bright hardening of the hi-carbon-hi-chrome and stainless steels. Lindberg Engineering Co.

Circle 36 on postcard for more data

Ram Type Universal Turret Lathe Offered in Three Models

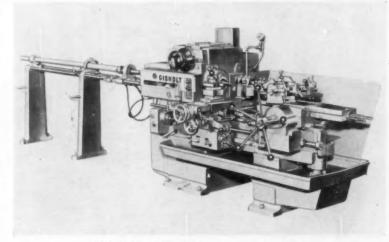
New throughout, both in styling and in construction, Masterline ram type universal turret lathes are available in three basic models. The No. 3 Lathe has a 11/2 in. round bar stock capacity, the No. 4 Lathe has a capacity of 2 in., and the No. 5 Lathe can be furnished to handle either 21/2 in. or 41/2 in. round bar stock through the spindle. All models can be equipped with the JETracer, mounted on the rear of the cross slide or on a single turret face. The machine can also be furnished with a Lynn hydraulic drive unit to provide completely automatic operation, as part of the original equipment.

A new bed design, with heavy webbing and cross supports, provides maximum rigidity. The bedways have been widened substantially to provide a better base for the turret saddle and for the cross slide carriage. The swing has been increased to permit handling a greater range of work.

The new headstock permits transmitting up to 30 hp through hardened and ground alloy steel gears and shafts mounted in anti-friction bearings. The No. 3 machine may be furnished with an 8 or 16-speed headstock. The 8-speed offers a standard spindle speed range of 40 to 1500 rpm, with a high range of 53 to 2000 rpm. The 16-speed offers a standard speed range of 30 to 1500 rpm and a high speed range of 40 to 2000 rpm. The No. 4 and No. 5 machines have as standard the 16-speed headstock.

A hydraulic speed selector is standard on all models. Speed shifts are controlled by movement of the speed selector handwheel, without stopping the spindle or disengaging the clutch. There are four headstock clutches (forward - reverse - high - low): and these are hydraulically actuated and of the multiple disc-type with hydraulic follow-up. With the hydraulic speed selector, the operator has a choice of "direct" or "pre-set" operation. Spindle speeds may be selected with reference to work diameters and surface speeds in fpm. A "high-low" trip lever offers an instantaneous speed change in a ratio of 8 to 1 when going from drilling, turning or boring to threading, forming or reaming, without moving the speed selector handwheel.

Swing over the ways for the No. 3 and No. 4 machines is 19½ in., and the No. 5 machine features a swing of 21% in. Longitudinal travel of the side carriage is 19½ in. for the No. 3 and No. 4 machines, 26% in. for the No. 5 2½-in. machine, and 25%



Gisholt Masterline No. 4 ram type universal turret lathe

in. for the No. 5 4½-in. machine. Cross travel of the cross slide is 10 in. for the No. 3 and No. 4 machines and 10½ in. for both sizes of the No. 5. Eight selective, reversible, power cross and longitudinal feeds are available to the universal side carriage ranging from 0.003 to 0.042 in. The turret ram is also provided with eight power longitudinal feeds ranging from 0.003 to 0.042 in.

The universal side carriage is furnished with a bridge-type cross slide and a quick indexing square turret. The eight selective, reversible, power cross and longitudinal feeds are available through a continuous rotating dial-type feed selector.

The hexagon turret ram and the saddle are wider and heavier with added rigidity to handle the loads imposed by increased horsepower and higher spindle speeds. Unclamping indexing and clamping of the hexagon turret is automatically actuated by movement of the turret ram. Gisholt Machine Co.

Circle 37 on postcard for more data

Cutting Blowpipe

A MACHINE cutting blowpipe capable of cutting metals ranging in thickness from light-gage sheet to eight-in. slabs has been introduced. It is designed for light-to-medium mechanized cutting with the Oxweld CM-45 portable machine carriage, but can be used with any machine carriage equipped with suitable blowpipe rigging. The blowpipe is intended for continuous or intermittent straightline, bevel, and circle-cutting operations.

A feature cited is the position of the cutting-oxygen valve at the front of the blowpipe, which enables the operator to concentrate on the workpiece as he starts the cut. It also eliminates the possibility of disturbing preheat valve adjustments. The blowpipe's rotary-motion cutting-oxygen valve is said to provide smooth operation without the jarring that normally occurs when starting cuts. Efficient mixing is

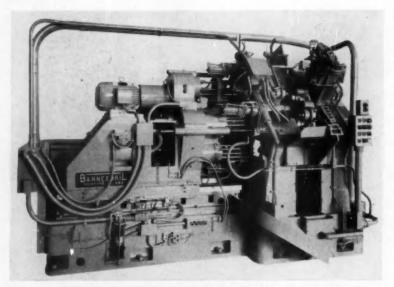
made possible by a cartridge-type mixer, which can be removed for maintenance without disturbing blowpipe alignment or rigging. A selection of cutting nozzles is available for use with oxy-acetylene, oxy-propane, and oxy-methane fuels. Linde Air Products Co.

Circle 38 on postcard for more data



Linde machine cutting blowpipe with Oxweld portable carriage

PRODUCTION EQUIPMENT



Barnesdril special eight-station drum type machine, for drilling, tapping and gaging operations on reor axle drive gear, consists of one U-2375 unit, eight-station hydraulically operated drum, one 50-spindle auxiliary head, and fixture with automatic loading and unloading mechanism.

Eight-Station Drum Type Machine

Four special eight-station drum type machines were recently completed for automated drilling, chamfering, reaming and tapping operations on a rear axle drive gear.

The gears are delivered by conveyor to a loading pocket on the machine. With a completely interlocked cycle the machine automatically picks up the gears by loading arm which moves them to the loading position. Here they are clamped in the holding fixture. In order to minimize the cycle time for the operation, the drilling is divided and performed at stations two and three. At station four a chip blowout unit cleans the holes and they are gaged by an automatic probing unit. Chamfering takes place at station five. All holes are reamed at station six. Five holes are tapped at station seven, and the remaining five are tapped at station eight. After the part has been indexed back to station one it is automatically unclamped and the unloading arm picks it up and moves it to the discharge chute for conveyor removal. At the same time the loading arm picks up a new gear and moves it to the loading station.

If inadequate depth of the holes or broken tools are found by the probing unit at station four the machine is automatically stopped and a warning signal is actuated. The machining cycle is resumed after the part has been removed through the reject chute, and proper tool corrections are made.

Production exceeds 200 per hour at 80 per cent efficiency. Barnes Drill

Circle 39 on postcard for more data

Control Transformers

Now being marketed is a new series of control transformers which is said to meet nominal performance requirements under off-standard or low-voltage conditions. This series was designated with five primary taps and four secondary taps to provide a selection of connections for off-standard supply applications.

The control transformer can be used on any application where primary supply is 208, 220, 240; 380, 400, 416; 440, 460, 480; 500, 550, 575 or 600 volts. It will provide output voltage of 85, 91, 95, 99; 100, 110, 115, 120; 125 or 130.

The manufacturer claims that by using this transformer (which is available in capacities of 50, 150, 250 and 500 volt-amperes) expensive, specially wound transformers, voltage boosting transformers, voltage regulators or voltage stabilizers will in general not be needed for the average pushbutton or automatic control installation under an off-standard voltage condition. Acme Electric Corp.

Circle 40 on postcard for more data

Plastic Forming

THE Optipeel plastic forming proc-ess is said to permit acrylic canopies or other contoured parts to be shaped without distortion and with consistently good optical properties. Prior to forming, the plastic sheet is covered with a coating called Optijel, a smooth, pliable plastic material. During the forming process, this coating becomes an integral part of the base sheet and, expanding with it, absorbs impurities, imperfections and other defects that normally would result in "mark-off" and/or distortion in the plastic sheet. After cooling, the marred coating of Optijel is peeled off, leaving the surface of the formed article smooth and unblemished. Plastic Age Sales, Inc.

Circle 41 on postcard for more data

Crane Scales

A^N expanded line of hydraulic crane scales, which includes 110 models with capacities from 500 to 200,000 lb, is now available. Known as Hydroscales, these weighing devices can be used on any standard crane or hoist



Hydroway crane scale

equipment to weigh any load while it is being lifted. The lifting eyes on the smaller models (up to 4000 lb) fit on standard five ton crane hooks; on models of greater capacity, they fit on any standard crane hooks. All models are provided with tare adjustment for known tare loads. Hydroway Scales, Inc.

Circle 42 on postcard for more data

Automatic Drilling

Featuring direct numerical input by means of dials or punched tape controls, the Model LD-24 automatic locating and drilling machine was recently demonstrated. It handles work up to 24-in. width. The one horse-power drill head will drill up to ½-in. holes in templates, panels, castings, etc. Hole positions are automatically located.

The operator sets length and width dimensions in increments of 0.001 in. on direct numerical dials and presses direction controls to set the machine in motion. Simultaneously, the drilling unit moves crosswise to the selected width dimension, while the table moves the work piece to the length dimension. As soon as the selected position is located, the drill feed is automatically actuated. If desired, the drilling operation can be controlled manually.

The equipment can also be controlled with the company's multiple channel programmer. Using permanent, grease-proof, vinyl tape previously prepared by set-up personnel, the operator merely loads and unloads. All required machine functions are signalled and controlled by the tape. Hillyer Instrument Co., Inc.

Circle 43 on postcard for more data

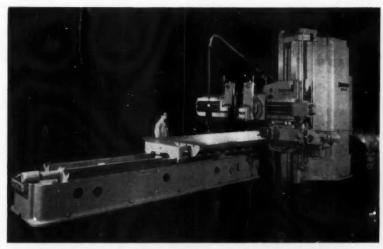
Mobile Air Supply

Usable for high pressure testing of landing gear, inflating tires, leakage testing, calibrating instruments and for starting jet aircraft, a 5000 psi source of dry air is offered in the ACE-36 mobile high pressure air



ACE-36 mobile high pressure air stand

stand. The compressor used is a fourstage unit rated for continuous duty at 5000 psi and powered by a 220/ 440-v a-c, three-phase, 60-cycle electric motor. Air is dried within the stand by a refrigerant type dehumidi-



Rockford hydraulic heavy-duty planer has three-lange drive and control from planer pendant

Heavy-Duty Planer Has Centralized Control

To complement the development of carbide tools and in keeping with the trend toward centralized machine controls, a heavy-duty planer is equipped with hydraulic-electric control of the drive. Actuation or control of all table and feed movements of the machine are from the planer pendant.

The drive, known as the H-3, features three ranges, combining the efficiency of a single circuit planer, with the speed required for carbide planing. It has two hydraulic cylinders with different areas. Solenoid-operated selector valves direct oil from the pump to either cylinder, or both in combination. Since the pump delivery can be applied to three areas, three force ranges are available with three inversely proportional speed ranges.

Speed range selection and cutting speed adjustment is available from the pendant. The electrically operated servo pump control is controlled from the pendant. A direct reading tachom-

eter dial is provided to indicate the cutting speed at which the table is traveling at all times. Return speed is independent and infinitely adjustable. Maximum return speed is available automatically at any cutting speed.

Cutting speed may be increased or decreased from the pendant by pushbutton while the machine table is running. Stepless adjustment in all ranges, from 0 to maximum, is available. Range selection is by means of a selector switch on the pendant. Feed actuation, at either the start or the end of the normal cutting stroke, may also be selected by a switch on the pendant. Inch control of the table, in either cut or return, is possible from the pendant. A selector switch provides a predetermined fixed inch speed for setup, and, in normal operation, by depressing the table cut button. the cutting speed drops to inch during the time the button remains depressed. Rockford Machine Tool Co.

Circle 44 on postcard for more data

fier, at the rate of 16 cfm. Desired dryness is selected by adjustment of the thermostat setting. Typically, a dryness equivalent to a dewpoint of -65 F is said to be attainable at an operating pressure of 3500 psi.

Two supply systems are available. One system supplies air for direct loading of bottles, for example, from the compressor. Discharge pressure is manually regulated for values up to full compressor cutout pressure. The second system may be set to automatically regulate the supply for

any desired pressure from about 100 to 5000 psi; and it passes through three 1500 cu in. capacity bottles which serve to maintain even pressure.

Overall size of the unit is 40-in. wide, 48-in. high and 70-in. long, exclusive of handle. Variations of the basic stand are obtainable, such as gasoline engine drive, more or less storage bottle capacity, and with or without the dehumidifier. Accessory Controls & Equipment Corp.

Circle 45 on postcard for more data



Wheelabrator Super Tumblast airless blast cleaner

Airless Abrasive Blast Cleaning Machine

Introduction has been made of a batch-type airless abrasive blast cleaning machine designed for cleaning sand, scale, oxides and other contaminants from any work that can withstand a tumbling action. The machine, known as the Super Tumblast, has an operating load capacity of 28 cu ft. Its single blast wheel throws 830 lb of abrasive per minute.

Wheel maintenance problems are said to have been minimized by the use of newly designed blades, a strainfree blade holding device to reduce breakage and simplify replacement, an easy-access wheel guard housing, and a completely revised system of wheel guard liners. The separator, using the air separation principle, is claimed to be effective in removing sand and scale from the abrasive and maintaining the optimum abrasive mixture throughout the blast cycle. The steel flight conveyor and other parts of the machine have been designed to avoid jamming of work of even the smallest size.

Equipped with standard power features, the unit may be converted to automatic operation, with a single pushbutton actuating the entire sequence from loading to unloading. Wheelabrator Corp.

Circle 46 on postcard for more data

Valves for Sequencing Type Air Circuits

Sequencing type air circuits can be controlled by the use of a line of sequence valves which were recently introduced. They provide for a preset pattern of operations to be automatically carried out by a machine after the operator initiates the cycle. Cylinders can be sequenced by position or time, and their action interlocked in the circuit.

In application, when the pilot valve is operated it provides the retrold (remote control) valve with air through an opening in the head, reversing the valve. Exhausting the pilot valve circuit returns the retrold valve to its normal position. Three

types of valve heads control these valves. The MV retrold valves have immediate actuation and immediate reversal. The TD sequence valves have delayed actuation and immediate reversal. The WV sequence valves have immediate actuation and delayed reversal.

Available models include straightways and three-ways, normally opened and normally closed. They are provided for in-line mounting, in sizes ¼ to 1¼ in. In addition, these models are built in two inch size for MV type operation. Ross Operating Valve Co.

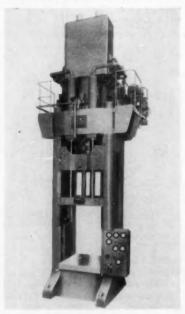
Circle 47 on postcard for more data

Triple-Acting Press

The new electric magnetic controls of a 575-ton hydraulic press enane the operator to make adjustments of speed, timing and pressure from the main control panel on the press. For instance: the ram can approach at maximum speed, slow down as it enters the draw, change speed during the draw, strip slowly, speed up, slow down again to pick up the blankholder and return to the up start position at maximum speed. This cycle pattern can be changed by resetting six control knobs on the main control panel. It is stated that the flexibility in cycle timing provides an added protection to dies by applying "easy" pressure at the point of contact and withdrawal. Because maximum speed can be maintained wherever possible during a complete stroke, the overall time is reduced to a minimum, it is said.

By eliminating the danger of building up work-hardening stresses during the press stroke, a result of the development of the electric magnetic cycle control system, it is now possible to more accurately draw-form difficult materials, the company indicates. This new triple-acting press has four-point pressure adjustment of the blankholder. By turning four wheels on the control panel of the press, the pressure required at each point is applied. A. B. Farquhar Div., The Oliver Corp.

Circle 48 on postcard for more data



Farguhar 575-ton press

Low Alloy Welding Wire

Designated A-S-8620, a chromenickel - molybdenum alloy automatic welding wire with less than two
per cent total alloy content is said
to be "sympathetic" towards practically all low alloys. It is of standard
AISI low alloy content. If the base
metal is of higher carbon, the carbon
pick-up from dilution in the weld
metal adds wear resistance and elongation qualities to prevent cracking
and spalling.

In its application, the formulation is suited for welding U. S. Steel's "T-1 Steel," an alloy with very high physical properties—tensile strength 105/130,000 psi; elongation 15 to 20 per cent; and Rockwell C20-35. With the proper flux (submerged arc) on T-1 steel, the welding wire gives a tensile strength of 114/116,000 psi; elongation of 12 to 15 per cent; a Rockwell of C28-30; and the chemical analysis as welded is very close in all elements to the parent T-1 steel. Face and root bends show 100 per cent efficiency and there is no "affected" zone, the announcement further states. American Chain & Cable

Circle 49 on postcard for more data

Liquid Core Paste

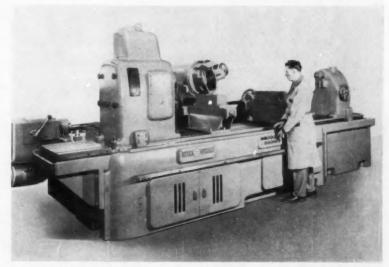
An improved version of Fastick liquid core paste for foundry use, has been announced. The new product is more viscous and the non-settling feature has been improved. It can now be left standing for weeks with no indication of separation. High tensile strength, low gas evolution, fast drying, low cost and uniform ready-to-use packaging are features which have been retained.

Case histories have proven Fastick an excellent replacement for clamps and backing substance with "C" shell and "D" process mold halves, as well as resin bonded and conventional sand cores, it is said. Frederic B. Stevens, Inc.

Circle 50 on postcard for more data

Leak Detector

A PORTABLE leak detector, capable of making tests on either evacuated or pressurized systems, is being offered. The instrument, known as Type 24-210, may be employed to show the existence or absence of minute leaks, to determine the rate of leakage, and to pinpoint the exact location of a leak. It is a simplified mass spectrometer which responds only to the



Red Ring Model GCJ-48 in. rotary gear shaver will crown-shave spur and helical gears up to 48-in. pitch diameter and 62-in. between centers

Machine Crown Shaves Gears of Large Diameter

The field of crown shaving has been expanded to include external gears up to 48-in. pitch diameter and 62-in. between centers by the development of a new rotary gear shaver. Spur and helical gears up to 12-in. wide and 52-in. OD in the 2 to 16 diam pitch range can be crown shaved on the machine. Shaving without crowning can be done on spur and helical gears up to 36-in. wide and 142-in. between centers in the same tooth size range.

The cutter head of the rotary gear shaver, called the Model GCJ-48 in., is mounted on a saddle at the rear of the machine. The work drives the cutter which is meshed with the work gear in crossed axes relationship during the shaving process. Either manual or automatic means can be used to feed the cutter into the work in selected increments from 0.001 to 0.003-in. at the end of each stroke of the cutter. Direction of rotation of the work is reversing at each end of each stroke to assure uniform shaving of both sides of the teeth. Axial travel of the saddle is controlled by a transmission that is clutched to provide both feed and traverse speeds. Pushbuttons control all machine functions.

Seven, 9 and 12-in. diam cutters are used on the shaver. A 5-hp motor drives the headstock and a 3-hp motor powers the cutter reciprocation drive. National Broach & Machine Co.

Circle 51 on postcard for more data

presence of helium as a tracer gas. By probe or air-sampling methods, it will detect one part of helium in 300,-000 parts of air. Applications include



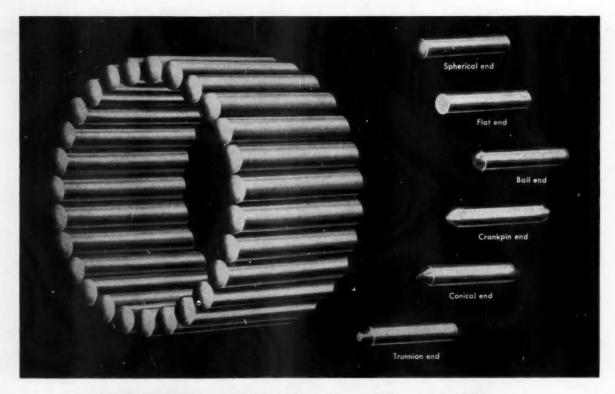
Consolidated leak detector

testing hermetically sealed parts, refrigeration units, high-vacuum systems and other containers depending upon a perfect seal.

An audio alarm and a mobile workstand are two of several accessories available. The alarm gives an audible indication of leak rate, enabling the operator to tell when the sampling probe approaches or passes over a leak. Pitch of the signal varies with the amount of helium entering the leak detector, giving a quantitative estimate of leak rate. Volume and threshold of the alarm are adjustable.

The 145-lb unit is 20½-in. high and requires a table area of only 18½ by 22-in. It operates on 105/125-v ac. Consolidated Electrodynamics Corp.

Circle 52 on posteard for more data



TORRINGTON Needle Rollers for the ultimate in load capacity at low cost

High radial capacity in minimum space stems from full complement of small-diameter rollers. Load zone contains maximum number of contact lines.



LOAD ZONE



High cerbon chrome steel is carefully hardened, ground and lapped to make each Needle Roller a precision part for long-life performance. life performance.

Close tolerances on Needle Rollers are assured by stringent quality controls. Standard OD tolerance is .0002" but rollers can be supplied with OD tolerance of .00005." Tolerance on length dimension depends on end formation.



without races between hardened shaft and hardened housing (RC-60 recommended), Needle Rollers allow largest possible shaft diameters. Fine finish contributes to efficient anti-friction performance. Needle Rollers are usually polished to 4-6 rms, but finishes as fine as 1-3 are available on special order.



Torrington Needle Rollers provide the lowest cost, highest capacity anti-friction bearings obtainable. They are manufactured in a complete line to meet SAE and AFBMA specifications. Available in the inexpensive spherical end type or in other end shapes, they provide maximum retainment and fillet clearances or greater lip retainment. Needle Roller standards for material, heat treat, tolerance and finish are the highest in the industry.

Good operating results with Needle Rollers require careful design of mating parts furnished by the user. The Engineering Department of The Torrington Company, with broad experience in applications of Needle Rollers, will be glad to give you technical advice on your needs.

THE TORRINGTON COMPANY South Bend 21, Ind. Torrington, Conn.

> District offices and distributors in principal cities of United States and Canada





Spherical Roller . Tapered Roller . Cylindrical Roller . Ball .

INFORMATION SERVICE

Use either of these postcards for Free Literature listed below, or for more information on New Production Equipment and New Products described in this issue.

USE THIS POSTCARD

FREE LITERATURE

Flame Machining

An eight-page booklet explains a process for producing large gears and sprockets automatically, by means of a fast-cutting torch guided by special cams and change gears for control of tooth shapes, sizes and spacings. Cogmatic Div., Seaman-Andwall Corp.

Hearth Furnace

A hearth type furnace for small parts, with radiant tube heating, is described in Bulletin SC-173, four pages. Surface Combustion Corp.

Metal-Cutting Saws

Information on a line of friction, abrasive, cut-off and long-cut saws is supplied in Catalog 1235, eight pages, made available by Ty-Sa-Man Machine

Automatic Gaging

A four-page folder deals with the application of automatic gaging to mass production operations and also points out semi-automatic and manual applications where air gaging can be used. Taft-Peirce Manufacturing Co.

Presses

Hydraulic and air-operated industrial presses of from 25 to 150-ton capacity, which feature a total of 10 different models for various industrial requirements, are covered in Bulletin DH-486, issued by Manley Div., American Chain & Cable Co.

Socket Screws

A revised 30-page catalog gives size ranges and specifications for Unbrako socket head capscrews, setscrews and other type fasteners. Standard Pressed Steel Co.

Welding Electrodes

Bulletin GED-3048, four pages, gives the features, deposition rates and properties of low-hydrogen, powdered-metal electrodes. General Electrie Co.

Detergent Oils

How to clean sludge out of hydraulic and lubrication systems without shutting down machines and the properties of Sunvis 700 oils are explained in Bulletin 44 issued by Sun Oil Co.

Microwave Components 9

A wide range of microwave components and mechanical assemblies are featured in a 22-page illustrated catalog available from J-V-M Engineering Co.

Stainless Pipe

Bulletin TB-410 provides information on the use of seamless and welded stainless steel pipe and stainless steel welding fittings in the process industry, where corrosion and/or elevated temperatures are determining factors. Tubular Products Div., Babcock & Wilcox Co.

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Circle code numbers below for Free Literature, New Product Information

Plant Equipment,

Die-less Duplicating

11

Described and illustrated in a 44page catalog is a line of metalworking machines that perform basic repetitive operations without the use of dies. O'Neil-Irwin Mfg. Co.

Bronze Bearings 12

Stock List S 56 provides data on an expanded line of standard self-lubricating bronze bearings. Amplex Div., Chrysler Corp.

Germanium Crystals 13

Bulletin SMEL #1, 22 pages, describes the crystal growing process and emphasizes the functions of control systems applicable to both the seed crystal and zone leveling methods. Brown Instruments Div., Minneapolis-Honeywell Regulator Co.

Machines, Tools

A 48-page catalog lists a line of punches, shears, presses, brakes, power presses and shears, small tools and other metal-working units. Whitney Metal Tool Co.

Induction Heating

Information on a small-target, highspeed detector and controller for highfrequency induction heating has been made available, in a two-page data sheet, by Leeds & Northrop Co.

Torque Manual 16

Outlined in a 28-page manual (second edition) are the operating principles and applications of torque tools, as well as torque specifications. P. A. Sturtevant Co.

USE THIS POSTCARD

Welding Equipment

Designated GEC-1033, a 20-page illustrated bulletin covers a full line of welding equipment, electrodes and accessories. Included are a-c and d-c general purpose and industrial welders, semi-automatic and automatic equipment, and carbon block brazing equipment. General Electric Co.

Teflon Products

18

19

Shown in Catalog T-55 are tapes, sheets, rods, tubes, gaskets and specialties made of Teflon. Properties and application data are included. Continental-Diamond Fibre Div .. Budd Co., Inc.

Tracer Control

Circular 597, four pages, describes the operating principles of an electronic tracer control system that enables the tracer point to follow the shape of a model without touching it. Pratt & Whitney Co.

Silicone Rubber 20

Bulletin 6903 furnishes data on the compounds available, as well as the properties of silicone rubber, including its resistance qualities under various conditions. Raybestos-Manhattan.

Molded Fiber Glass 21

A 16-page catalog describes a molded fiber glass molding process and lists the various mechanical, electrical and chemical properties of this reinforced plastic. Molded Fiber Glass Co.

Titanium 22

An eight-page bulletin contains data on the corrosion resistance properties of titanium and lists corrosion ratings for titanium when it is exposed to various common types of corrosive agents. Mallory-Sharon Titanium Corp.

Lubrication Guide

Available is a 20-page lubrication guide covering the lubrication systems and requirements of a particular line of machinery. Equipment covered includes power presses; bolt, nut, screw and rivet machinery; and rolling mill machinery. Waterbury Farrell Foundry & Machine Co.

Carbide Tools

Catalog 56, 32 pages, covers a line of carbide tool products and includes information on blanks, inserts, carbide tipped tools, etc. Write on company letterhead to Coromant Div., Sandvik Steel, Inc., 1702 Nevins Road, Fair Lawn, N. J.



Payloader" Parts Produce Production Profit

...When Made From a COPPERWELD LEADED ALLOY

This complex gear assembly is made in six separate operations, or set-ups, with a tooling sequence of 13 machining operations. When the manufacturer switched from unleaded to Copperweld leaded 8620, the faster feeds and speeds gave them a production increase of better than 25%. For example, the surface feet per minute in a finish bore operation increased from 200 SFM to 300 SFM. In addition, tool life increased 60%. Copperweld Leaded Steel, the steel with "built-in productivity" produced profit in this "Payloader" part.



For further details, write for free booklet, "Lead Treated Steels"

COPPERWELD STEEL COMPANY • STEEL DIVISION • WARREN, OHIO EXPORT: Copperweld Steel International Co., 225 Broadway, New York 7, N. Y.

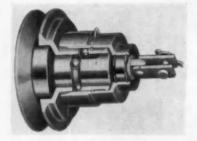
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PRODUCTS AUTOMOTIVE AVIATION

FOR ADDITIONAL INFORMATION, please use reply card on PAGE 89

Clutch for V-Belt Drives

Called the "End Thrust" type clutch series, these units are announced for application on V-belt drives up to 7½ hp. They mount on electric motors and gasoline engines, and are usable on pumps and gear reducers and for intermittent and high-speed clutching. The clutches consist of three basic parts — a central hub and end disk (one-half of the V-belt pulley) and an idler bearing onto which the slack



belt drops when the clutch is disengaged; a slideable pulley side that moves in or out to effect engagement or release, the body of which serves as the retainer or carrier for the load-carrying balls; and an outer sleeve or cam which restrains and applies pressure to the balls and also carries the thrust ball bearing element by which the clutch is actuated.

Smooth engagement without belt grab is said to be a design feature as the clutch must be manually closed before the balls lock. Closing pressure required is 20 to 35 lb through a short travel. Actuation is by hand, cam, spring, air, solenoid or any mechanical means. Release is claimed to be instant because all belt pressure is removed as the pulley sides open. V-Belt Clutch Co.

Circle 60 on postcord for more data

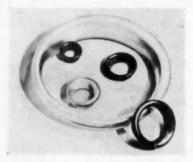
Non-Skid Tread Plate

A non-skid abrasive aluminum tread plate for providing sure footing even when covered with oil, grease or water, was recently placed on the market. It is designed for such items as bus steps and aisles, marine and printing press catwalks, military gun mounts, passenger trains, and truck and trailer floors. The product is rolled from ingot by a method which provides a fused aluminum abrasive oxide on one surface of the plate. The layer of abrasive is metallurgically bonded to the aluminum plate; and in welding, for instance, the abrasive layer does not separate from the plate. Durable and corrosion-resistant, it can be shop fabricated by most commercial methods, including shearing, sawing, punching and drilling, according to a booklet just published. Aluminum Co. of America.

Circle 61 on postcard for more data

Sealing Washers

Nyltite rolled washers, made from Zytel, are slipped over the bolt and when pressure is applied to tighten the fastener, the washer cold-flows around the fastener head. The product's hugging qualities fill the space between threads and hole for providing air-tight, leak-proof seals. These "con-

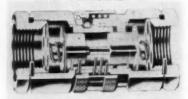


trolled-flow" washers are also said to act as a locking device, prevent galling, and dampen the effect of vibration. They may be used under bolt or screw head and between the nut and surface. Nyllite Corp. of America.

Circle 62 on posteard for more data

Quick Coupling

Known as the HK coupling, a new quick connect-disconnect coupling for acids, alkali, solvents and high pressure steam has been announced. Its



use is said to be limited only by the ability of its Teflon nipple seals and valve seals for which there is no known solvent. The unit is designed to function through a —100 F to a +500 F temperature range and may be subjected to lower and high temperatures for short periods.

Manufactured from solid bar stock, the coupling can be furnished in 303 and 316 stainless steels. brass, aluminum, special carbon steel, or other materials. It is available plain (without valves); or with automatic shutoff valves incorporated in either or both ends, causing the valved end of the line to shut off immediately and automatically upon disconnection. When connected, the coupling valves automatically open. The coupling is manufactured in ½ through 3 in. ID pipe sizes, with any type end connection desired. Snap-Tite, Inc.

Circle 63 on postcard for more data

Special-Duty Points

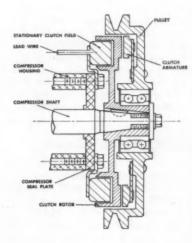
Special duty distributor points, identified as the IAD series, are a new product designed exclusively for use on vehicles operating at low engine speeds.

Contact surfaces have 78 per cent more contact area than standard point sets. Breaker arm has broad-beam construction and is reinforced for added strength. The Electric Auto-Lite Co.

Circle 64 on postcard for more data

Compressor Clutch

An electro-magnetic clutch is said to improve operating efficiency where truck refrigeration drive systems are powered by belt-driven compressors. Automatic control can be achieved by the use of a thermostatic control wired



to the new clutch, so that the refrigerating compressor need only run when cooling is required and can free-wheel when cooling is not necessary.

The basic elements of the clutch are a stationary magnetic field mounted on the compressor seal plate and a composite rotor-armature-pulley assembly mounted on the compressor shaft. The clutch rotor is keyed to the drive shaft and the armature-pulley assembly free wheels on a ball bearing mounted on the rotor hub, when the clutch is not energized. The armaturepulley assembly is driven by a vee belt from the gasoline engine or power take-off. When the thermostatic control calls for cold, the clutch field is energized electrically and the rotor (keyed to the compressor drive shaft) attracts the armature, completing the magnetic circuit and driving the compressor. Warner Electric Brake & Clutch Co.

Circle 65 on posteard for more data

Ignition Distributor

An external adjustment ignition distributor, recently developed, is said to combine increased timing accuracy for high-compression engines with unprecedented ease of servicing. Contact point opening, or dwell angle, is adjustable through a "window" while the engine is running, and without removal of the distributor cap. An ordinary hex wrench is the only tool required to make the adjustment. Contact points are replaced as a unit by the removal of two attaching screws. The points are aligned, and the braker lever spring tension set, at the factory.

The newly-designed, all-weather distributor cap is removed by turning two spring loaded latches with a screwdriver. A new, one-piece, concentric bearing breaker plate improves vacuum advance performance. Delco-Remy Div., General Motors Corp.

Circle 66 on postcard for more data

Miniature Pump

Featuring high power to weight ratio, a series of miniaturized oil-hydraulic pumps has been developed for limited-life airborne applications such as in missile hydraulic systems and motor-pump assembly installations for supplying emergency power on aircraft. Under conditions of optimum system operating pressure and maximum design speed, certain models are said to be capable of develop-



ing more than six horsepower per pound of total weight.

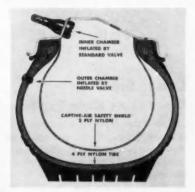
Typical of these pumps is the 3906 model, smallest in the new line. This unit is 2½ in. long, is 1% in. diam. and weighs less than one pound. With 15-deg stroke angle, it is rated at 4.4 hp and 2.5 gpm flow when operating at 12,000 rpm with a system operating pressure of 3000 psi.

The pumps are intended for use with system operating pressures up to 3000 psi, and are available with maximum rated power outputs up to 15.3 hp. A variety of flange arrangements and shaft configurations are obtainable to meet different installation requirements. Vickers Inc.

Circle 67 on postcard for more data

Safety Tire

Development of a safety automobile tire with a "built-in spare" that will keep going for 100 miles or more after a blowout, was recently announced. Named the "Captive-Air," it is described by the company as a new concept in construction, the use of a tire within a tire. In case of a



blowout or puncture to the outer chamber, the car is supported by the inner chamber. There is no air passage connection between the inner and outer chambers.

In addition to the regular rim valve, the tire has a self-sealing valve in the sidewall. First step for inserting air is to insert the inflation needle in the sidewall valve. Next, the inner chamber is inflated through the rim valve to the tire's recommended operating pressure. Then the air hose is attached to the sidewall inflation needle and the outer chamber inflated to the same pressure. When air pressure in service drops below the recommended level, replacement air is added only through the valve to the inner chamber - adding two pounds for each pound needed as shown by the air gage reading. Air is equalized in the two chambers by filtering very slowly through the inner chamber. Goodyear Tire & Rubber Co.

Circle 68 on postcard for more data

Tachograph Linkage

Mechanical linkage for tachographs incorporating a new cable, called the Rotoflex, which utilizes as its outer layer a unique, spirally-wound helix wire to provide a high strength-to-weight ratio, is now being marketed. The use of a single-piece linkage for runs up to 45 ft in length are said to be practical and trouble-free. Teleflex, Inc.

Circle 69 on postcard for more data

METALS

Outlook Good for Steel Sales During Second Half of Year Despite Mounting Inventories in Some Consumers' Hands

By William F. Boericke

Lower Steel Operating Rate Expected

The steel industry continued to operate at a high rate throughout the second quarter but that isn't taken as any guarantee that the third quarter won't run into a rather pronounced seasonal slump, strike or no strike. Anticipating a possible work stoppage, consumers have been stocking up, their decision fortified because of the certainty that steel prices will be higher to compensate for increased wage costs.

The amount of the price increase for basic steel is unknown but it will hardly be less than 40 times every cent of hourly wage hike. Some steel executives have been talking of 60 to 1. Last year a 15-cent an hour wage increase brought a \$7.35 per ton increase in basic steel.

Customers' inventories are causing concern among some producers. One of the big steel makers estimated that 10 per cent of its steel shipped has gone into inventory and the chairman of U. S. Steel is quoted as saying that inventories are being built up at a very rapid rate.

Unbalanced Inventories

Admittedly, however, the situation is unbalanced. While Iron Age estimates that steel inventories in consumers' hands are expected to reach an all-time high by the end of the second quarter, it is pointed out that this isn't true for critical products such as plates, structurals and oil country goods for which demand is as strong as ever and likely to remain so. There is no heavy inventory of tubular goods and at least one Texas pipe manufacturer is reported operating considerably over 100 per cent capacity.

Much the same can be said for structural steel for which demand gives no indication of letup. Expenditures for capital equipment are rising and should reach a peak in the fourth quarter. The Federal highway program will add to the demand with the need for some 25,000 bridges for the new highways calling for a hugh tonnage of special shapes.

On the other hand, cold rolled sheets and strip are in comparatively easy supply. Some automobile manufacturers have sharply slashed their July steel requirements and have no idea what they will need in later months. Warehouse stocks appear ample in most lines. Appliance manufacturers, hurt by cutbacks in Detroit, have also had to curtail purchases. Cancellations thus far have not been serious but are causing some worry. It appears obvious that if extra inventories have to be run off the production rate for the lighter steels will have to come down, not only to consumption level but even below to prevent accumulation of over supply.

Generally Good Outlook Ahead

A recent survey among steel executives shows general confidence in outlook for the second half of the year, with 40 per cent expecting increased sales, 35 per cent no change, and 25 per cent looking for lower volume. Nothing has developed to change the intention of the industry to expand capacity over the next five years by 15 million tons. Indicative of this was the recent announcement that U. S. Steel's Fairless Works would increase capacity 50 per cent by mid-1957.

A drop in the operating rate in the third quarter would not be unwelcome to most steel companies. Furnace and equipment repairs are badly needed and cannot be postponed indefinitely. Many mills have been running on borrowed time during the first half of the year. Some producers have told their customers that there can be no guarantee of delivery after July 1.

Prices for steel scrap continued to soften through June and by the middle of the month were off over \$8 from the March peak. Mills cut their purchasing pending outcome of the labor talks. Less agitation for congressional measures to limit exports is heard in consequence.

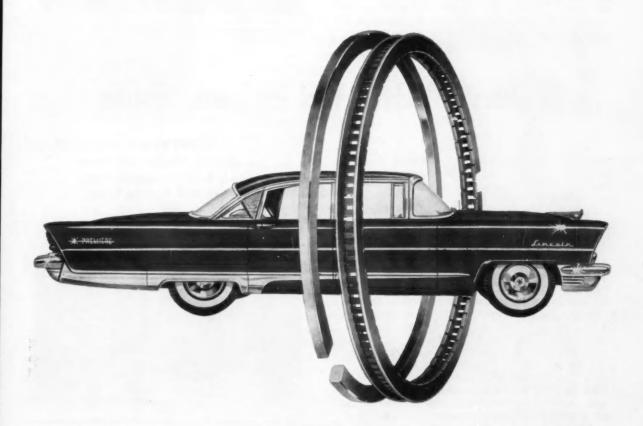
Nickel Scarcity

Small consumers of nickel are protesting bitterly over inability to get supplies at a reasonable price. While the official price remained unchanged through June the outside market was far above $64\frac{1}{2}$ cents per lb. International Nickel has indicated its unwillingness to advance its price although there are rumors that a new Canadian company will build a smelter with a guarantee from a large consumer to take part of its output at \$1.15 per lb. This may augur the price trend for nickel over the future.

The Director of ODM testifying before the Senate Small Business Committee declared there is not enough nickel available to satisfy the total demand for defense and non-defense purposes, a statement that should surprise no one. He revealed that the national stock-

(Turn to page 102, please)

Designed for DUTY



in LINCOLN engines

Lincoln...like many other leading engine manufacturers selects and distributes...for authorized replacement service

PERFECT CIRCLE

2 in 1 chrome piston rings...the standard of comparison

AUTOMOTIVE INDUSTRIES, July 1, 1956

A LTHOUGH Vickers, Inc., has held a number of hydraulic forums during the past few years, the second Machine Tool Hydraulic Forum held in May was easily the largest of the series, boasting a registration of over 200 people. Generally speaking, the guests at this important two-day event included master mechanics from the automotive plants, and chief engineers of selected machine tool plants.

Among the special events on the program was the keynote address by Louis Polk, president, The Sheffield Corp. and president of the National Machine Tool Builders' Association; and an illustrated talk by Nevin L. Bean, Ford Motor Co., covering his observations on Russian production and automation. Moderators of the comprehensive forum meeting



Keynoter Louis Polk, president—Sheffield Corp., and NMTBA

Vickers' Machine Tool Hydraulic Forum

were R. L. Dustman, productive equipment manager of Chevrolet, representing the automotive group, and Hans Ernst, director of research, The Cincinnati Milling Machine Co.

The scope of the program, as usual, covered the gamut of hydraulics problems, including the following topics: circuits, fittings and tubing, fluids, cylinders, pump and valve design, fluid motors, filters, maintenance, and seals. And as usual the participants were encouraged to air problems and troubles with the objective of finding solutions that would aid individual companies as well as advance the art.

Despite the improvements that occur in due course, it was evident that leakage still constitutes a trouble-some problem for most users. Among the troubles mentioned most were: leaks in fittings, plumbing and accessories; surge and shock in the system.

On specific matters—many users expressed a preference for separate power units for each machine head rather than operating from a central pump system. Users still are asking for a standardized method of clamping for hydraulic plumbing lines. While on the subject of plumbing, it is noteworthy that the argument persists as to the relative merits of pipe fittings vs straight thread fittings.

Nothing new has happened in fire resistant fluids except for a better understanding of mutual problems. The so-called "leak resistant" hydraulic fluids came in for attention and the consensus seemed to be that these materials are relatively short lived in machine tool service.

Considerable attention was devoted to oil filters. It was not news that most users are sold on the application of by-pass filters. However, attention was drawn to the need for a definite signal to indicate when the filter required attention. There was agree-

LATEST TRENDS
in Fittings, Filters and Seals
Among Topics at Largest Meeting of Its Kind Held by Vickers,

Inc.



The two moderators—R. L. Dustman, Chevrolet productive equipment manager (left) and Hans Ernst, director of research, Cincinnati Milling Machine Co.

ment that one of the best devices for this purpose is a pressure gage. It was noted too that fire resistant fluids also required filtering, this application being satisfied by special filtering elements.

One of the questions dealt with the reactivation of defense plant machine tools, The consensus of the experts was that all of the hydraulic units, coils, and solenoids would be usable, provided government procedures were followed when the equipment was

(Turn to page 119, please)

Using

DU PONT ELASTOMERS





New opportunities in design— Colored HYPALON® is highly resistant to ozone and weather

Hypalon, Du Pont's new synthetic rubber, can be compounded in white or in an unlimited range of brilliant colors that remain stable under exposure to light. This offers style-conscious designers the services of a rugged elastomer, capable of blending beautifully with any of the various automotive paint colors.

Of practical importance to the rubber stylist is the fact that the entire rubber part need not be HYPALON. Ordinary rubber can be dressed up in a colorful HYPALON coating—applied either as a liquid or as a mechanical skin. Such coatings, or veneers, bond well to most other elastomers, and they are as free to flex and stretch as the rubber part to which they are applied.

HYPALON's resistance to weathering and ultraviolet light has been demonstrated in long-time exposure tests in Florida and Delaware. Brightly colored specimens, in a variety of shades and hues, were exposed to the elements for thirty months with negligible effect on properties or appearance.

In addition to resistance to sunlight and weather, Hypalon has unusual resistance to ozone. In fact, no Hypalon product has ever been reported to develop an ozone crack, not even the Hypalon gaskets used to seal laboratory and commercial ozone generators in which the ozone concentration may reach six per

Investigate the possibilities for using HYPALON in automotive design by mailing the coupon at the right.

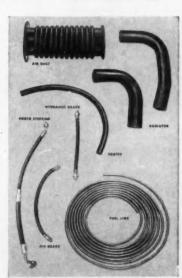
NEOPRENE demonstrates its versatility, long service life in hose and tubing

Resistance to oil, ozone, heat and weather—key advantages

There's a lot of hose on a car, and it's subject to all manner of abuse. Heat, hot oil and ozone combine to attack any rubber material under the hood, and weathering is an everpresent problem. It takes an unusual—and versatile—rubber to take this kind of punishment. That's why neoprene is used by so many car manufacturers for hose and tubing.

In the photograph at the right you will find some of the many hose and tubing applications for neoprene. On radiator and heater hose the neoprene cover resists the attack of heat and ozone and the neoprene tube resists the soluble-oil rust inhibitors used in anti-freeze. Hydraulic brake hose is protected by neoprene from heat, ozone and weather. Power steering hose—with cover and tube of neoprene—gives extra-long service despite exposure to heat and ozone on the outside, and to hot oil on the inside.

The list of hose and tubing applications for neoprene continues to grow, but neoprene has many other uses in the automotive industry. It's being used as a diaphragm in power-brake units because it can withstand



MANY VARIETIES of neoprene hose and tubing serve the automotive industry. All have this in common: extra-long service life.

heat and flexing. Resistance to ozone, oil and engine heat make neoprene the standard for jacketing on ignition wire. You'll also find neoprene used in seals and boots, flexible couplings, and as a saturant in paper gaskets.

How can you use neoprene's unique balanced combination of properties? Further property and application data are available. Just clip and mail coupon below.



HYPALON is a registered trademark of E. I. du Pont de Nemours & Co. (Inc.

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& Co. (Inc.)	V

Please send further information
and add my name to the mailing
list for your free publications,
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which show how the Du Pont
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City	State	

Observations

By Joseph Geschelin

Radiated Plastics

Stanford Research Institute reports the commercial development of irradiated electrical insulation material capable of withstanding high temperatures without melting. They refer to "Hydrad" a new insulated wire developed by the Sequoia Process Corp. Initial test work produced a special polyethylene plastic coating which, under radiation, results in a vastly improved insulating material. Ability to withstand temperatures of 300 F makes Hydrad particularly suitable for insulated wire and cable in jet aircraft and in certain electronic components. The cable also is amenable to iron and dip soldering; immersion briefly in molten solder at 480 F does not harm Hydrad.

Road Test

Compact road test instruments for experimental cars used in research by oil companies and vehicle producers have been developed recently by Allen Electric and shown in a test car at Atlantic City. One of the most impressive of these is a small spark advance unit employing a transistor circuit, independent of battery voltage. It reads ignition advance in engine degrees from 10-deg retard to 50-deg advance directly on the dial. Accuracy is of the order of plus or minus 1/2 crankshaft degree. Four instruments constitute a pack which can be mounted directly on the instrument panel either singly or in a special

Wheels Brakes

From what we can gather the wheel picture will be confused on 1957 models. Some makes will have 14-in. wheels, others will retain 15-in. wheels If this is true then it will take another model year before 14-in. wheels predominate across the board. We also learn that one prominent parts maker will offer an entirely new brake system with independent but coordinated operation for the front and rear systems.

Aluminum Radiators

The session on aluminum radiators at the SAE Summer Meeting covered the gamut of problems and projected designs ranging from aluminum fins to all-aluminum construction. One gathered that progress has been made in aluminum fin-brass tube designs which may find their way into some 1957 cars. The all aluminum design still remains in the future. What appeared certain was this: that anticipated changes in the price of copper will no longer permit aluminum developments to lag. Apparently the car producers are determined that some shift from copper must be made in the interest of materials conservation.

Industrial Design

Speaking at the dedication of the new Institute of Design, Illinois Institute of Technology recently, Henry Dreyfuss touched on the philosophy of an industrial designer. He does not think solely in terms of what a thing looks like. First considerations are of convenience, utility, safety, cost, and maintenance. Only then does the designer add his knowledge of line, form and color, proportion and texture. Having known Henry Dreyfuss for many years, we can add that he spends a lot of time in manufacturing plants and has a keen sense of practicality and costs.

Bearings Brinell

The phenomenon of bearing brinelling while vehicles are in transit in haul-away trucks and on freight cars appeared many years ago and apparently was satisfactorily resolved at the time. In any event most people have forgotten about it. We hear now that the same thing has occurred in the case of trailer suspensions incident to the growing use of piggyback railroad operations. One solution has been the employment of rubber-bushed suspension elements.

Piston Rings

Piston ring makers are faced with rapidly changing times. For 1957 practically every V-8 will bloom with a larger bore. One may not realize it but passenger car bores next year will be in the class reserved heretofore for heavy duty commercial engines. In some cases these sizes just about tax the capacity of high production equipment in use at the present time.

Seeking Materials

Larger cylinder bores and narrow piston ring width now pose the problem of finding higher strength ductile materials for piston rings. The major piston ring producers are working feverishly at this right now. There are a number of avenues for exploration. One is the development of heat treated alloy iron formulations. Another is the use of centrifugally-cast alloy irons. And one of the most promising, according to Muskegon Piston Ring, is the development of gintered alloys which appear to have extremely high physical properties together with adequate ductility.

Epoxy Tools

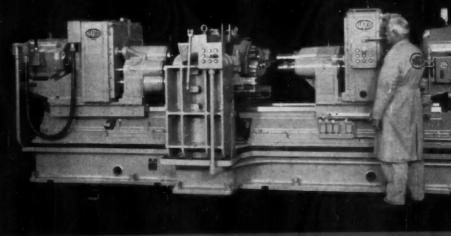
Epoxy resin tooling has made enormous strides in a comparatively short time. It is being used for master Keller die models with resulting improvement in accuracy. Besides the more familiar uses, epoxy dies are giving good service on relatively simple parts, with a life expectancy up to 50,000 pieces. Besides using such dies for short runs and experimental production to develop new techniques, it is likely that epoxy dies will make more frequent product changes economical and will make it feasible to make more sets to serve assembly plants. An interesting recent development is the experimental use of epoxy dies for injection molding machines. Another noteworthy application of recent origin is the use of epoxy resin match plates for foundries.

Natco Automatic Matches **Boring Mill** Accuracy

and quickly converts for five different jobs







This Natco two-way machine stepped in where automatics "fear to tread!" It replaced a precision boring mill, speeded production and didn't give up a tenth in accuracy! At The Frank G. Hough Co. boring mills were used for exacting tolerances on transmission parts for the Hough Payloader®. Higher production

Now with a Natco two-way automatic, Hough is getting production rates not job shop rates. The Natco bores diameters to within .0005"—square with mounting face within .0005" per inch bore length. The machine also chamfers, counterbores and notches boss contours.

Versatile tool Hough processes five different transmission housings or covers with a single machine. After a typical production run averaging 100 parts, the

machine is quickly converted to another job.

Ask for information about the PAYD (Pay-As-You-Depreciate) Finance Plan.

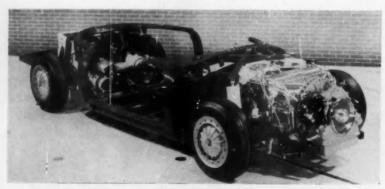
National Automatic Tool Company, Inc.

Multiple-spindle drilling, boring, facing and tapping machines. Special machin



Major Engine Projects Unveiled at SAE Summer Meeting

(Continued from page 63)



Front quarter view of the Firebird II chassis

all diameter. A 16 in. diameter x 7.5 in. wide rim section is used. The radial tire thickness is reduced so that the overall diameter of the 8.20 tire is 27.3 in. This tire section provides good steering response with some

sacrifice in softness. In order to maintain satisfactory sidewall deflections, inflation pressures of 42 psi are used both front and rear.

The wheels are made of cast magnesium and are chromium plated. The

SAE

SUMMER

MEETING

(Continued)

separate rim is sealed with a large "O" ring to permit the use of tubeless tires and is held in place with bolts. The wheel spokes and the rim flange act as a blower for cooling the brake disk. Three steel pins bolted to the inside of the wheel engage and drive the disk links.

Hydraulic System

A central hydraulic system using "Type A" transmission fluid provides the necessary power for suspension leveling, brake booster, power steering, and windshield wipers. The system is shown schematically in Fig. 4. The pump, built by Saginaw Steering Gear, operates whenever the system pressure drops below 850 psi and bypasses when the pressure reaches 1100 psi. The pump has a capacity of 1.4 gpm at 2000 rpm of the propeller shaft. Two accumulators, one at the front and one at the rear of the car, serve to store energy to meet peak load demands. The high pressure and return lines to the pump and integral sump are installed in the fore and aft square tubes through the floor to provide service to brake booster, wipers, steering, and front suspension at the front of the car.

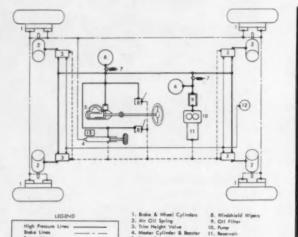


Fig. 4—Chassis of General Motors Firebird II, experimental car powered by new GT-304 Whirlfire gas turbine of 200 hp. At the rear can be seen the alternator, air conditioning compressor, and the hydraulic system oil pump driven by the transmission input shaft. Chassis dimensions:

Capacity—4 passengers Wheelbase—120 in. Front Tread—60 in. Rear Tread—57 in. Length Overali—235 in. Width Overali—70.6 in. Height Overali—52.8 in. Front Overhang—49 in.
Rear Overhang—66 in.
Cowl Height—36.8 in.
Ground Clearance—5.5 in.
Turning Radius—26.7 ft.
Curb Weight—Oil &
Fuel Tanks Full—5300 lb.

Applications of Radioactivity for the Control and Testing of Automotive Materials

By H. A. Tuttle and G. E. Noakes

Manufacturing Research Dept.

FORD MOTOR CO.

THE term non-destructive testing, although it normally would include radiography, is used to classify those applications where a measurement is made on a process or part without interfering with the operation or destroying the part. The term implies batch type testing or individual unit testing rather than continuous gaging. The applications of radioactivity to this type of testing in automotive production have been numerous. The following are two such examples:

Example 1—Penetron Pipe and Wall Thickness Measurement

When it is necessary to measure the wall thickness of pipes, tanks, or tubes with only one side accessible, a commercial instrument of the Pene-

(Turn to page 106, please)



HOW WE GO TO ANY LENGTH...OR WIDTH... to help you save money on wire cloth components!

• Wire cloth users are experiencing a couple of new reasons why it pays to do business with the Reynolds Wire Division of National-Standard.

Here's the idea. . . .

In blanking or forming wire cloth components, a roll of wire cloth 2 to 8 times normal length means 2 to 8 times as much production in a single run without a shutdown. It also means less waste and less handling!

Similarly, when cloth is pre-slit (as shown above) to exactly the width a customer really needs, this too results in less waste, faster production and reduced handling.

So these days Reynolds Wire is departing more and more from old established industry standards . . . producing wire cloth in continuous lengths up to 800 feet instead of standard 100-foot rolls . . . and furnishing pre-slit cloth as narrow as 1 inch wide and even less.

Why not talk with Reynolds about your wire cloth needs? If we can help you cut production costs you'll be ahead on *every* count...for there's no better, more uniform wire cloth than that you can get from Reynolds. Try us.

NATIONAL-STANDARD COMPANY • NILES, MICHIGAN
Tire Wire, Stainless, Fabricated Braids and Tape

ATHENIA STEEL DIVISION . CLIFTON, N. J. Flat, High Carbon, Cold Rolled Spring Steel

REYNOLDS WIRE DIVISION • DIXON, ILLINOIS
Industrial Wire Cloth



WAGNER LITHO MACHINERY • JERSEY CITY, N. J.
Special Machinery for Metal Decorating

WORCESTER WIRE WORKS DIVISION • WORCESTER, MASS.
Round and Shaped Steel Wire, Small Sizes

METALS

(Continued from page 94)

pile had reached the half-way mark and that increased production would make available an additional 128 million lb annually. At present the Government is hoping to increase the supply for both civilian and defense needs by 140 million lb. It was stated that the shortage would be worse if substantial diversions had not been made from shipments scheduled for the stockpile. Starting in the fourth quarter, the Government plans to put distribution controls on nickel alloy deliveries. Details of the controls would be worked out by the Commerce Department.

Indicative of the nickel scarcity is an announcement by International Nickel Co. that it cannot promise delivery of monel metal earlier than 18 months ahead.

Brass Mills Cut Work Week

The latest figures for the copper fabricators give rather convincing evidence that all is not well in the brass industry. A generally lower level of activity is apparent. At the end of April new orders had declined 35 per cent. Stocks of metal were up to 414,000 tons, the highest for eight years. Sales dropped to 93,600 tons, down from 135,700 tons in March. Very definitely it's a buyers' market.

This is reflected in the announcement that some brass mills are now on a four-day week or less, and some have laid off workers. In part this shows the effect of production cutbacks by the automobile manufacturers who normally take 20 per cent of brass mill products. In general, wire mills have been less affected.

It appears certain that the fabricators are carrying the load of unsold copper. The Copper Institute figures for May show domestic producers are still in a comfortable position. May deliveries were at the same level as April and stocks of copper totalled only 53,400 tons, barely 10 days supply at indicated delivery rate. However, stocks of copper held abroad by foreign producers were up rather sharply to 196,000 tons.

Copper Declines In World Markets

At mid-June the copper price varied widely here and abroad. After falling to 36½ cents per lb on the London Metal Exchange, the price steadied at 38 cents. Meanwhile, the Prain

group, controlling about half the Rhodesian output, cut its price to 40 cents, but still above the LME market. Custom smelters, after slashing their price from 55½ cents to 40 cents, held firm at that price. The producers' officia, price remained unchanged, during all this turmoil, at 46 cents.

The best opinion is that the producers will make no effort to change their price until they get a better idea of July orders. Customers may ask for enough July copper to permit the 46 cent price to hold, particularly as a contract would call for the price prevailing on date of shipment. This would protect the buyer so that he would get the benefit of any subsequent cut in the producers' price.

An agreement was reached between the Mine & Smelter Workers Union and the American Brass Co. for a new three-year contract covering the company's plants. It provides for a 24-cent an hour wage increase and fringe benefits that bring the package to 34 cents. This could provide the pattern for other agreements in the fabricating field and would appear to forestall danger of a strike.

Zinc Shipments Down

Zinc Institute figures for May were not encouraging to producers and made undeniably bad reading. Domestic shipments declined 15,500 tons during the month. The Government took 10,200 tons from producers for the stockpile, more than twice as much as was offered the month before. If this hadn't been done almost certainly the market would have declined. Stocks of zinc increased 11,600 tons at the end of May and are now the highest for a year. Unfilled orders dropped 12,100 tons from the month before.

The outlook for zinc is certainly clouded. The Detroit cut-backs have hurt sales of special high grade zinc for die casting. This reflects a slump in industrial buying, not only from the automobile makers but from manufacturers of special equipment as well.

There is also considerable uneasiness over the possibility of a steel strike which would, of course, affect the galvanizers who take about 40 per cent of Prime Western metal. The statistical position would probably be even worse if it had not been for the long drawn-out strike at two of the country's principal zinc smelters that cut off a large source of supply.

However, the chances are that Government buying for the stockpile will continue to take the surplus, and the general feeling is that the price will not be allowed to decline below 13½ cents as long as this support continues.

Lead Featureless

Although domestic sales of lead have been uninspiring it is thought the price will remain firm at 16 cents, reflecting the support by the Government by which it will take considerable amounts of lead of foreign origin in exchange for surplus agricultural products, and thus prevent this metal from being offered as imports on the domestic market.

While reports of battery sales show a decline, again reflecting the cutback in automobile output, nevertheless battery makers are optimistic about a good sales volume this year.

ASQC Convention

(Continued from page 51)

Quality control technicians must be utilized, who are trained specifically in the fundamentals of automation, in addition to their complete understanding of the fundamentals and applications of statistical and inspection techniques. In the present day inventory of quality control personnel, there is an abundant supply of halftrained technicians. Through specialization, these men have become so thoroughly familiar with a particular type of manufacturing process that many of the present day quality control programs become ineffective as soon as the manufacturing process is converted to automatic programming.

Once the organization has been staffed with an adequate amount of qualified personnel, we must provide these men with the proper tools. As in the case of the automated process itself, whereby a different type of tool is required, so too with the quality control program. The quality control technicians must be equipped with the statistical weapons of charting and analysis, as well as a revised set of mathematical formulae, in order to accomplish the program requirements. Many of the older types of charts will have to be revised to incorporate the changes in inspection frequency that are effected by automated processes, as well as to allow for "process qualification." On operations which for-

(Turn to page 111, please)

XV

This is the sixteenth of a series of advertisements dealing with basic facts about alloy steels. Though much of the information is elementary, we believe it will be of interest to many in this field, including men of broad experience who may find it useful to review fundamentals from time to time.

Copper: Its Principal Effects in Alloy Steels

One of the best known of all metals, copper certainly needs no introduction here. Its uses are legion. It is one of the best conductors of heat and electricity. It is popular with the housewife, essential to the engineer. But possibly not so well known is its very important function as an alloying element in certain types of steels. So used, copper increases resistance to atmospheric corrosion and also acts as a strengthening agent.

Since copper does not oxidize in the steel melt, it can be added at any time during the course of the heat. Pure copper melts at about 1980 deg F.

Copper is added to steel in varying amounts. The actual proportion, of course, depends upon the end product in mind. Some of the most widely used copper-bearing steels are those containing from 0.20 to 0.50 pct. In these, copper has been found to increase corrosion-resistance without materially affecting mechanical properties. It has been found, too, that paint frequently lasts longer on such steels than on the non-copper-bearing types.

Among the best known of the copper-bearing steels are the high-strength, low-alloy grades developed in recent years. Generally speaking, the ductility of steels in this group is comparable to that of conven-

tional structural steel. The yield strength, however, is usually higher. Copper, working as a team with chromium, nickel, and phosphorus, substantially raises the level of corrosion-resistance in these steels; yet its presence does not adversely affect welding characteristics.

Copper-bearing steels are a subject in themselves, a subject in which Bethlehem metallurgists are well versed. If you would care to know more about this interesting group of steels, feel free to consult with our technicians. They will gladly work closely with you and help with any problems you may encounter. And please remember, too, when you need alloy steels of any kind, that Bethlehem manufactures the full range of AISI standard alloy grades, as well as special-analysis steels and all carbon grades.

If you would like reprints of this entire series of advertisements, Nos. I through XVI, please write to us, addressing your request to Publications Dept., Bethlehem Steel Company, Bethlehem, Pa. The material is now available in a convenient 32-page booklet, and we shall be very glad to send you a free copy.

BETHLEHEM STEEL COMPANY BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation



BETHLEHEM STEEL

Detroit Tooling Conference

(Continued from page 50)

experimental setup with an intricate forming tool. Hook also mentioned that prices quoted by various producers vary considerably, some quotations being extremely high by comparison with cemented-carbide tips.

A discussion of the hot work tool steels for forging, die casting, and extrusion dies was presented by H. E. Repogle, Universal-Cyclops Steel Corp. He cited examples of specific applications and indicated the recommended compositions, heat treatment, and hardness for each case.

A comprehensive discussion of the product-tooling-management equation was made by Clyde Mooney, Engineering Service, Inc., describing the teamwork required on the part of the complicated management team in developing economical part design to the production stage.

The broad subject of capital facilities planning and analysis was covered by R. T. Thornton and C. E. Beck, Jr., Ford Motor Co. Successful facility planning requires close cooperation between production, engineering, and finance in selecting the equipment or plant that will yield the highest return on the capital employed. They emphasized the Ford philosophy of "flexibility plus high productivity" and pointed out the need for equipment that produces low-cost, high quality parts which, at the same time, has the desired flexibility so it may be easily adapted to accommodate product changes.

The involved and extremely complicated relationships between the machine tool builder and the production department, engineering, and other management groups in the customer's plant was sketched by Leo Gajda, Snyder Tool & Engineering Co., in a paper entitled "Teamwork Requirements from Conception to Installation of Capital Equipment." It was a timely coverage of an exceedingly important subject, one that is not fully appreciated by people not directly concerned with the details of selecting, designing, and getting into operation the complicated and expensive machine tools of this automation era.

Other papers presented at the conference included the following: Vacuum Melting Techniques for High Temperature and High Purity Metals, by W. E. Jones, Carboloy Dept., Genera! Electric Co.; Mechanical Properties as Related to Perfection of Crystals, by Dr. R. L. Eisner, Westinghouse Electric Co.; Processing New Automotive Engines, by H. R. Bently, Chrysler Corp.; Chronocyclograph and Memomotion Studies, by Prof. R. S. Jones, Wayne University; Radioactive Isotopes in Research with Materials and Tools, by H. R. Lissner, Wayne University; Effects of Nuclear Radiation on Materials in Atomic Power Plants, by D. O. Leeser, Atomic Power Development Associates, Inc.; New Applications and Process Developments with Aluminum and its Impact on Tooling, by P. E. Brandt, Reynolds Metals Co.; Technical Illustration, by E. R. Whelan of Chrysler.

Principal speaker at the banquet was A. L. Boegehold, manager of Research Staff Activities, General Motors Corp. His subject—Materials in the Automobile of the Future—covered the gamut of materials, particularly the light metals such as aluminum and magnesium, and other alloys related to the probable changes in motor car design of the future.

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SAE Summer Meeting

(Continued from page 100)

tron type is used. For flat or nearly flat surfaces, the thickness is related to the amount of back scatter of the gamma rays from a radium source. For pipes less than six inches in diameter, the absorbance along a chord is measured. Use of the gage has made it possible to determine the extent of corrosion in high pressure steam lines, gas mains and acid tanks without shutting down the operation.

On one occasion a four inch highpressure steam line in the Power House ruptured. The question arose as to whether or not the entire boiler system should be shut down for repairs. By an inspection of the lines with the Penetron the hazardous portions were replaced and the boiler placed back in operation without a costly and time-consuming major repair program.

Example 2-Engine Block Oil Hole Wall Measurement

In the machining of the V-8 engine block using automation equipment it was found that one specific oil hole feeding a main bearing was drifting. In some blocks the hole had actually broken through the outer surface. It was immediately apparent that inspection of the blocks was required to ensure that sufficient wall thickness was present. Since no mechanical gage could be used in this application a radioisotope gage was devised. A probe was tipped with a quantity of radioactive Ruthenium and inserted into the oil hole. The intensity of beta radiation received by a Geiger counter held against the outer surface of the block determined the thickness of the metal remaining. The energy of the source was such that the beta radiation was detected only if the wall thickness was less than 0.080 in. In this manner several hundred engine blocks were quickly inspected. The information made it possible to segregate that the difficulty was caused by a core shift and not a drill drift in that particular group of engine block castings.

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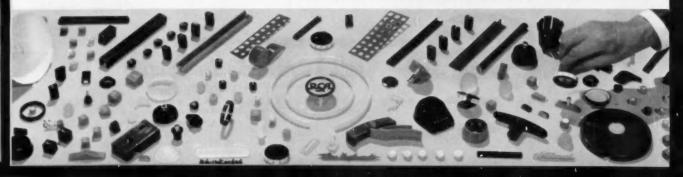
reinforced fibreglass and copolymers. American's giant plant can handle every stage of manufacture from design to mass production. Regardless of whether your plastic problem is clear-cut or complex . . . regardless whether your needs are small or large, call upon American for the economical, quality answer. Write direct for further information today. Address Dept. A



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their range of application in the diesel engine industry.

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MODEL	T-10	T-15	T-16	1-30
Diameter - in. nom.	9	151/4	111/2	151/4
Length - in.	9	163/4	153/4	171/4
Weight - Ib.	39	125	100	135
Output - Ib/min. (Standard Conditions)	25-40	35-65	45-65	70-95



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Compare the appearance of the used Sunvis 900 with the appearance of the other used oil. The color of used Sunvis 900 is practically the same as new Sunvis 900. There is not a sign of oxidation products.

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For more information about Sunvis 900 oils, see your Sun representative, or write for Technical Bulletin 35. Address Sun Oil COMPANY, Philadelphia 3, Pa., Dept. I-31.

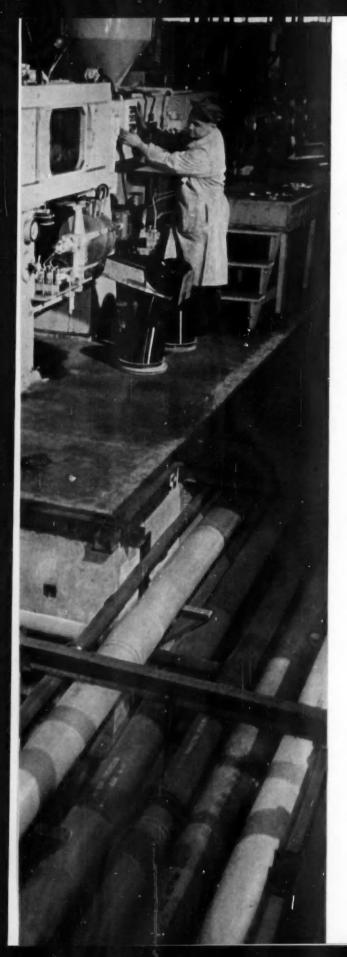
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High-Pressure Pumps, below, each handle 54 gpm of Sunvis 931 at 2500 psi. Unique closed-loop hydraulic system, left, features color-coded piping.



NEW CENTRAL HYDRAULIC SYSTEM PROTECTED BY SUNVIS 931 OIL

The new variable-pressure hydraulic system at Columbia Records in Bridgeport, Conn., delivers oil at 2500 psi to as many as 40 injection molding machines. Round-the-clock production of micro-groove records depends on the reliability of this system.

Columbia picked Sunvis 931 because their tests and experience have shown it doesn't form carbon or leave harmful deposits...even after years of use. Because of their long life, Sunvis 900 oils are the least expensive oils you can buy for tight circulating systems.

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ASQC

(Continued from page 102)

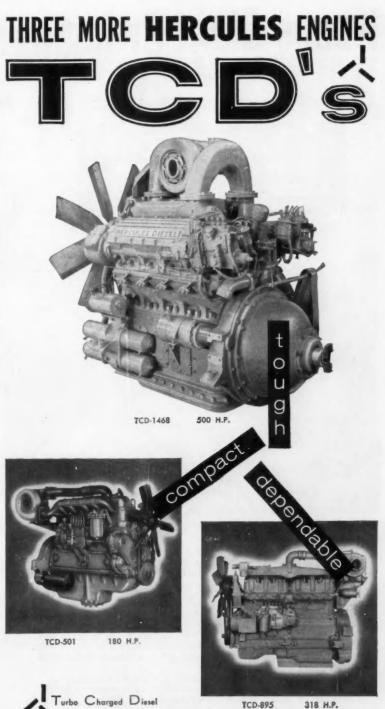
merly required a statistical sample of five pieces per hour, an inspection frequency of one sample per one hundred pieces produced will usually provide as accurate an analysis of quality. The effect, however, will provide a reduced inspection cost to the operations. On other types of automated operations, 100 per cent inspection will be utilized in preference to statistical sampling. In addition, it is wise to note that the various levels of inspection plans, such as reduced, tightened and normal inspection, will be used very rarely on an in-process operation. Instead, the frequency of inspection will be changed, depending on the product quality. In all cases however, the standard of inspection will remain the same.

The third and most important step in our program development will consist of eliminating from our mental attitudes the "lazy" philosophy of establishing a quality control program in an area where it is easy to make a good showing. When a company invests the large amount of money that is required to facilitize an automation program, the service-type of organization, such as quality control, must adapt itself to the philosophy of providing a service where it is needed rather than where it is convenient to do so. Unless this goal is accomplished, the quality control technician will find himself in as antiquated a position as the machines which were replaced by automation. The development of a quality control program for automation must be based on the requirements of maintaining an even flow of production.

CONTROLLING QUALITY OF BONDED STRUCTURE FOR AIRCRAFT

By Wallace Hay Convair-Fort Worth

PROBLEM that plagues the user of supported a dhesive (wherein some close-weave fabric such as nylon or glass cloth is the supporting agent) is uneven distribution of adhesive on both sides of the carrier. This cannot be determined readily by inspection techniques during checks for weight or thickness, but can mean the difference between a good panel and a poor one depending on which way the person laying up the panel orients the (Turn to page 112, please)



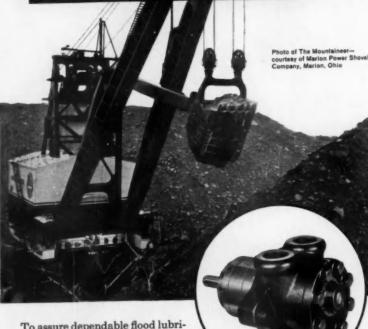
Turbo Charged Diesel

Following the Hercules policy of providing industry with the latest in engine developments, the above Hercules TCD's are available for applications requiring Tough Compact Dependable power. Complete details on these TCD's are available from the factory. Write for Bulletins D-534, D-561 and D-567.

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To assure dependable flood lubrication on the swing gear units of this 2600-ton power shovel, Marion engineers selected Tuthill Model L positive displacement, internal-gear rotary pumps to do the job.

It was this type of Tuthill pump that pioneered the first practical mechanical seal for leak-free performance and low power consumption. Since 1927, hundreds of thousands of these compact small pumps have demonstrated their dependability to hold prime, deliver capacity needed, and operate quietly and uninterruptedly.

Whether your production calls for standard pumping units or special pumps for engineered applications in lubrication, coolant, hydraulic or liquid transfer service, you are invited to submit your specifications for recommendation.

Write for catalog data for lubrication or other specific needs.

See our catalog in Sweet's Product Design File 6b-Tu



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Dependable Rotary Pumps . . . since 1927 939 East 95th Street, Chicago 19, Illinois

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Ingersoll, Ontario, Canada

ASQC

(Continued from page 111)

After sad experience had enlightened us, we devised a "hot patch" test to find this variation and prevent manufacture of poor quality panels. This test is designed to work on adhesives having some volatiles evolve during cure; and so far we haven't found any adhesives that don't fill this requirement. A two in. by two in. square of adhesive is placed on a thin sheet of aluminum, pressed down around the periphery and put in an oven at curing temperature. One sample is made with one side of the adhesive placed against the metal, and the other sample with the opposite side against the metal. If the adhesive distribution is about equal on each side of the carrier, the "hot patch" will show an even raised bubble due to the gas trapped between the carrier and the aluminum. The adhesive surface will be quite even provided the adhesive has good "flow." If on the other hand, if one side has a large share of all the adhesive, the sample with this side away from the aluminum will show large blisters or craters due to the inability of the volatiles to penetrate without forming these large blisters. Adhesives with poor flow characteristics will show this blistering, no matter what side is toward the metal. With poor flow, the relative amount of adhesive on each side of the carrier has little bearing on "hot patch results."

Admittedly, these tests are empirical and do not in any way, shape or manner duplicate the exact production bonding conditions. However, we are able to predict the results of destructive tests on finished panels from the results of these simple control tests.

Expanded Resins

(Continued from page 49)

strength of bond between a prefoamed resin core and other assembly components is equal to the strength of the bonding agent, provided that manufacturing processes have resulted in a good 'glue line.'

Access openings through which resins (either liquid or granular) are introduced must be provided at the upper part of each cavity to be filled with foamed-in-place resins. These openings must be of such a nature

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YOU SAVE MORE than just fuel costs when you convert to LP-Gas and Century Carburetion—actually you save on oil and on engine maintenance, too.

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Write for information about Century Carburetors and the new Model H Converter built especially for fork lifts and industrial trucks.

CENTURY GAS EQUIPMENT CO., PARAMOUNT, CALIFORNIA



EASY TO INSTALL

that the entire quantity of resin formulation required can be introduced into the lowest portion of the cavity within 10 to 20 sec after pouring is begun.

The recommended volume range of cavities to be filled with foamed-inplace resins is from two cubic inches to two cubic feet; sizes not included in this range are often difficult to fill properly and generally require special tooling and foaming techniques.

The maximum recommended foam rise for designs is approximately three feet; when this figure is exceeded, assembly costs generally rise in proportion to the special manufacturing techniques required.

Certain conditions will cause internal pressures in excess of 100 psi due to the foaming action of some types of foamed-in-place materials. The isocyanate-type foams used at Northrop generate foaming pressures of less than 28 psi. This means that adequate restraining tooling must be provided for the manufacture of foamed parts.

When sources of excessive heat such as electron tubes or high-wattage resistors are embedded in expanded resins, a 'heat sink,' or other satisfactory means of heat removal by conduction, should be incorporated into the design. This is necessary because the excellent thermal insulation provided by the foam will allow a heat build-up (if the source is great enough) and a subsequent damage to parts will be caused by overheating.

The total amount of resin required to fill a cavity is dependent upon the surface area as well as the volume and the core density. Foamed-in-place resins form relatively dense skins as they come in contact with another surface; for instance, a core density may be only four pounds/cubic foot while the density of the skin may be as much as 70/lb cu ft.

The tooling for foamed-in-place assemblies must usually be developed with each new design application. It is very essential that the tooling provides adequate support to such assemblies so they will not be distorted by gas pressures during the foaming process. The tooling for prefoamed assemblies is also frequently developed during prototype assembly fabrication. Therefore, close coordination with tooling liaison is strongly recommended by Northrop.

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From a new kind of plant comes a new breed of bearings—mated to the new needs of a mushrooming automobile industry



Introducing TIMKEN® and the Moto-Mated Way

A DESIGN revolution has created a new breed of cars that impose new demands on component parts.

To meet the big change in cars the Timken Company has introduced a whole new concept in bearing design, manufacture and supply, mated to the needs of a mushrooming auto industry. We call it the Moto-Mated Way. Launched in a revolutionary new plant, it re-cements our 57-year partnership with the automotive industry.

What is the Moto-Mated Way?

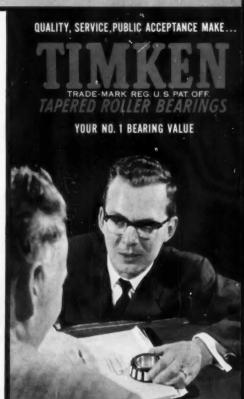
1) It's a forward-looking partnership with the automotive industry that anticipates your changing requirements. 2) It's providing you with a better product for less. 3) It's an almost unlimited source of supply. 4) It's putting advanced machines to work to provide even better jobs for the people in our plants.

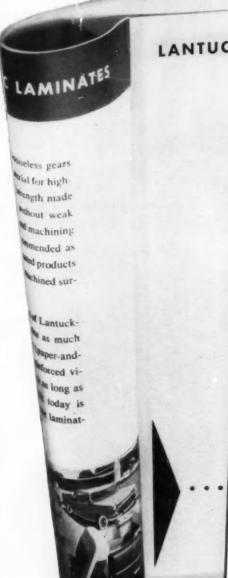
Out of the Moto-Mated Way come

new Timken* tapered roller bearing designs that are smaller, permitting more compact designs. Lighter, cutting unsprung weight, to give a better ride. Lower priced, off-setting spiralling costs. And packing maximum capacity in minimum space.

By adopting the new standardized Timken bearing sizes for front wheels, the auto industry has saved 11.3% or more over previous designs. And as use of the new sizes grows—in rear wheels, pinions and differentials—so will the savings.

Our engineers are eager to work drawing board to drawing board with you—as usual—to be sure you get all the extra advantages the Moto-Mated Way offers for design, production and purchasing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".





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The success of Lantuck in plastic laminates naturally aroused the interest of other people using plastics. Coaters soon recognized that Lantuck had special advantages as a backing fabric for vinyl. Its random fiber distribution assured balanced strength. It also provided good tear strength and flexibility, smooth surface excellent for embossing, with no "show-through" of weave pattern. And Lantuck offers coaters a high gauge-weight ratio at reasonable cost. Lantuck may be calender coated, laminated, or electronically heat sealed to vinyl film. It is available in widths up to 60".

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V-8 Engine Production

(Continued from page 55)

the familiar LeBlond crankshaft lathes for turning pins and journals. The crankshaft is given a final balance in the large Gisholt Dynetric balancer, illustrated here, holding balance to ¼ oz in. at each end. Balance drilling is done with angular spindles in the rear of the machine without removing the shaft from the cradle.

A distinctive feature is found in the special Avey oil hole drilling machines in which the crankshaft is mounted in a vertical position on the fixture and engaged by four angular drill heads disposed about the fixture.

Connecting rods are forged integrally with the cap and the two pieces handled in pairs after parting. Most of the detail operations-boring, drilling, counterboring, etc .- are handled in special Natco machines. An interesting piece of equipment on this line is the special Snyder weightmilling machine designed to produce rod and cap assemblies of uniform weight and balance. As illustrated, the rod and cap assembly is weighed on the Shadograph. The information is then transmitted automatically to the Snyder control unit where the milling cutter heads for each end are automatically adjusted to remove the proper amount of excess metal. Taking the complete assembly, including the fastenings, balance is held to plus or minus ¼ oz in.

As mentioned earlier, the connecting rod big end is finish-ground in a Heald Gage-Matic. This operation is held to plus or minus 0.00025 in.

The cylinder head, like the block, is machined in a sequence of operations in individual special machines. First operation is the milling of top and bottom faces in a Cincinnati mill equipped with two vertical spindles. As shown, it takes two heads at a time-one head milling the top, the other the bottom. After the cycle has been completed, the operator reverses the heads in the fixtures to finish the job.

Most of the detail operations are performed in a variety of Natco waytype machines, as illustrated. Noteworthy is the special Natco for drilling spark plug holes which has a two-station central indexing fixture, holding two heads in vertical position at each station. The work is indexed around for drilling at four heads.

The combustion chambers are fully machined. For this purpose, Cincinnati supplied a special version of its Hydro-tel, which has four spindles in horizontal plane, each controlled by the master tracer.

At the end of the line, the finish cut is made on the cylinder head gasket surface. Then the heads enter a Kearney & Trecker milling machine for finish-milling the intake manifold mating face.

The front cover, a rather intricate casting, combining water pump, oil distribution, and ignition distributor

mounting, is handled in a compact department on a variety of individual machines. The first operation, illustrated here, is the milling of faces in a special Newton milling machine fitted with two vertical spindles.

The flywheel for this engine is a large cup-shaped part with a flange on its outer face. Balancing is done on a special Gisholt Dynetric machine, holding dynamic balance to plus or minus 0.2-oz in.

All of the new machine tools are provided with hydraulic and electrical equipment in accordance with JIC standards. A noteworthy feature



PERMANENT FILTER SCREEN and 3 COMPLETELY AUTOMATIC CLEANING DEVICES

Combines the new Delpark powerful magnetic separator with a permanent filter media bar stock screen. Swarf bearing liquids flow on top of a large flat magnetic field. Magnetic unit incorporates more Alnico #5 magnets, gives twice the width of field, brings all swarf in suspension within the influence of the magnetic field, puts gravity to work in assisting the magnetic field, puts gravity to work in assisting the magnetic and prevents washing and turbidity by using low velocity flow. This feature is particularly desirable on high viscosity fluids. high viscosity fluids.

Three cleaning devices, completely automatic, re-move the separated residue from the unit. Chain driven flights remove deposits from the magnetic field and the bar stock screen. .004" bar screen is cleaned

by an air shaker device to dislodge enmeshed par-ticles. A drag-out unit is built into the clean coolant tank.

Up-Flo Filters are available without magnetics for non-ferrous metal applications.

See your Delpark representative for more complete

FILTRATION

NDUSTRIAL FILTRATION COMPANY



The PATTON Pullers are available in complete sets to handle a range of sizes from 3" to 4½" or individual pullers may be supplied. Larger or special sizes can be custom made for specific requirements.

Originally designed for the Armed Forces, the PATTON Puller is now used in machine shops and maintenance and repair shops in the following industries: aviation, automotive, agriculture, construction, marine and oil fields. In fact, wherever machinery and equipment is repaired, PATTON Pullers save costly man hours and prevent unnecessary damage to component parrs.

Write for complete descriptive literature.

PARTS LIST						
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PM-8051 (Set) PM-8001-1 assy.	7900-573279 7900-573265-5	111/32 -4 1/4				
PM-8001-2 assy. PM-8001-3 assy.	7900-573265-75 7900-573266	13/14 - 23/12				
PM-8001-4 assy. PM-8001-5 assy.	7900-573266-25 7900-573266-5	1 3/22"-1 1/4"				
PM-8001-6 assy. PM-8051-3 assy.	7900-573266-75 7900-573267-5	12//2"-1 1//4				

Other Sizes Available
Pat. No. 2380068 and Patent Pending

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1802 West Pleasant St.
Springfield, Ohio

is the installation of a Briggs fullers' earth type filter for each machine to keep the hydraulic fluid clean and free from varnish. Each filter is provided with a pressure gage to indicate when the cartridge is to be replaced.

One of the significant features of this engine is found in the design and arrangement of cooling passages in the block and head and other parts. In addition to quality control in the foundry, the inspection department keeps a careful watch on the castings entering the machine shops. One routine device is the sectioning of major castings during each shift, using a big DoAll hydraulic saw. As the sections are removed, the inspectors probe the various water passages to make sure they are up to standard requirements.

Material Handling

(Continued from page 71)

WAREHOUSE LAYOUT

Four major considerations for warehouse layout-popularity, similarity, size and characteristics of items-are the key to stock positioning and space control, according to Andrew J. Briggs, Materials Handling and Warehouse Branch, U. S. Navy Bureau of Supplies and Accounts. Ranking popularity first in importance, he mentioned a study which disclosed that approximately 90 per cent of the work was accomplished on about 15 per cent of the items. To obtain the data necessary for evolving a storage layout based upon these considerations, Mr. Briggs referred to a planning work sheet and a planning analysis sheet which had been developed for the purpose.

AUTOMATION

The general subject of automation and common beliefs about its economic status were reviewed and analyzed by James R. Bright of Harvard University, who had recently completed a 13-plant study. He disclaimed that the purpose of automation is to eliminate labor, pointing out that while there is a reduction in labor content per unit of product, there is a distinction between eliminating labor and raising productivity per man hour. In 9 out of 13 plants the latter applied. In the matter of first cost, he stated that one of the effects of automation is to pull the plant into a smaller building, so that where this can be done to a sufficient degree there is a good chance of getting an

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Sta-Warm dipping unit in packaging dept. of leading cutting tool manufacturer showing protective strip-coating being applied to new tools.

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automatic plant for the same money as a conventional plant. Added maintenance problems and high maintenance cost do not necessarily apply to automatic plants, according to Mr. Bright. He cited instances where the maintenance requirements became less than the conventional equipment. Mr. Bright also contended that despite the general feeling that it means upgrading of jobs, his suspicion was that it was downgrading the requirements and making people more employable. Hydraulic repairmen, pneumatic repairmen and electricians were given as exceptions.

NEW OFFICERS

The new officers of the Society, who were installed at the first national dinner held in the Cleveland Hotel on June 6, are: president-Herbert S. Jones, Dominion Bridge Co.; first vice president - Frank L. LaTour, Mohawk Carpet Mills; second vice president - William E. Cappler, American Aviation Corp.; secretary-Lynn J. Riege, U. S. Gypsum Co.; and treasurer-Alfred J. Van Benschoten, Manhattan Rubber Div., Raybestos-Manhattan Corp.

Vickers' **Hydraulic Forum**

(Continued from page 96)

mothballed originally.

That industry in general needs trained people for designing and servicing hydraulic, electrical, and electronic equipment was reemphasized at this meeting. Discussion indicated that individual users-at least the larger companies-were training people in their own technical schools, thus supplementing the basic training such as provided by Vickers and extending the influence of the program over a wider area.

Louis Polk touched on the ever tightening tolerance limits in manufacturing. He confirmed the dilemma faced by manufacturers of jet engine components where tolerances of the order of five-millionths of an inch are being demanded. The next step in gaging and measurement is out in the seventh decimal place (0.0000001) one tenth of a millionth of an inch. It is the requirement for gaging devices that must be capable of checking dimensions specified in the millionths

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AGMA

(Continued from page 65)

after the symposium, Nathan Finkelstein of Ford Motor Co., said that in the automobile industry there is no great concern about gear strength. He remarked that cars seldom break gears, but noise is a real problem.

New officers of the Association elected for the fiscal year were: President, Gunnar E. Gunderson, president, Brad Foote Gear Works, Inc.; Vice President, LeRoy R. Brooks, president, Tool Steel Gear & Pinion Co.; Freasurer, Thomas A. Jones, general manager, Jones Machinery Div., Hewitt-Robins, Inc.

Members elected to the Executive Committee include: Charles F. Bannan, vice president, Western Gear Works; Robert M. Honegger, vice president and general manager, Buffalo plant, Farrel-Birmingham Co., Inc.; H. O. James, president, D. O. James Gear Mfg. Co.; Charles L. Kessler, president, Beaver Gear Works, Inc.; and James F. Murray, president, Winsmith, Inc.

John H. Flagg, president, The Watson-Flagg Machine Co., Inc., was the recipient of the Association's "Edward P. Connell" Award for 1956. He was cited for promoting the standards and practices of the gear industry and for his many contributions to the art of gearing.

BOOKS ...

ASTM STANDARD ON LIGHT METALS AND ALLOYS, published by American Society for Teating Materials, 1916 Race St., Philadelphia 3, Pa. Price, \$3.50. The third edition of this work includes not only those specifications and methods of test that come under the jurisdiction of the sponsoring committee, but also specifications prepared by other committees, including those for aluminum wire and cable for electrical purposes, aluminum and aluminum alloy are-welding electrodes, and brazing filler metal. The standards include ingots, castings, bars, rods, wire, forgings, pipe and tube, sheet and plate, electroplating, and general methods of test. The ASTM codification system for light metals and alloys is also included.

BASIC EFFECTS OF ENVIRONMENT ON THE STRENGTH, SCALING, AND EMBRITTLEMENT OF METALS AT HIGH TEMPERATURES, published by American Society for Testing Materials, 1916 Race St., Philadelphia 2, Pa. Price, 32.75. This symposium, sponsored by a general research panel of the ASTM-ASME Joint Committee, attempts to analyze the effects of environment upon the creep rate and ductility of the metals that the design engineer uses. The panel has collected a great deal of data on oxidation and surface effects, as well as on creep under controlled atmospheres.



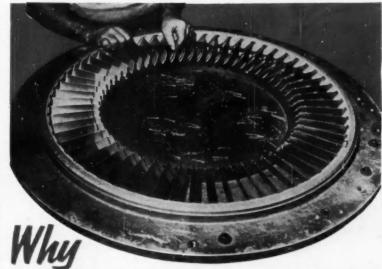
Businessmen expect new plant and equipment outlays to increase steadily through the third quarter of 1956. Dept. of Commerce and Securities and Exchange Commission have announced. Second and third quarter outlays are planned at seasonally adjusted annual rates of \$34.8 billion and \$36.7 billion, respectively: actual spending in the opening quarter of this year was at a \$32.8 billion rate.

Congressional passage was expected momentarily at presstime of a record \$32.9 billion highway construction program. It will be financed by increased road user taxes at a contemplated annual rate beginning July 1 of \$612 million for a period of 16 years for total \$14.814 billion.

High cost of national defense (now running at the rate of nearly \$100 million per day) is to climb still higher in the new fiscal year starting July 1. Aside from Congressional sentiment for accelerated production of military hardware, rising costs of materials are forcing defense contractors and subcontractors to mark up the price tags on many items sold to the Government.

Air Force scientists are backing up their intensive research on nuclear engines for future aircraft by exploring the possibility of chemical power for supersonic bombers. Air Force places a "chemical-powered bomber" on a high-priority development list that includes atom-powered bombers, ballistic missiles, and long-range radar.

Renegotiation is slowly but surely becoming a permanent feature of Government procurement. The existing law expires at the end of this year, and the Administration is pressing Congress for a two-year extension.



these stator blades for Curtiss-Wright J 65 jet engines are brazed with EASY-FLO*

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SHORTIES

It is estimated that one-sixth of all patents granted by the U.S. Patent Office have been for automotive inventions. The total number of automotive patents granted to date is close to 500.000.

Approximately 2000 companies in the U. S. manufacture vehicles and equipment; 57 make tires and tubes, and 40,000 are engaged in petroleum producing, refining and blending.

About 466,000 oil wells in 27 states supply 357 refineries, which in turn meet the highway transportation demand for 43 billion gal of gasoline and oil annually.

About 85 per cent of new rubber consumed in the U. S. goes into motor vehicles. Tires and tubes alone take 75 per cent of the new rubber used.

Thirty-five major U. S. aircraft manufacturers, including airframe, aircraft engine, and major component manufacturers, spend 54 per cent of each contracting dollar in sub-contracting and supply. These companies purchase materials directly from 50,000 business firms in every state of the union.

The wings of a new U. S. supersonic jet fighter are proportionately thinner than a double-edged razor blade.

The extent to which agriculture has been mechanized is indicated by the fact that there are now well over four million farm tractors.

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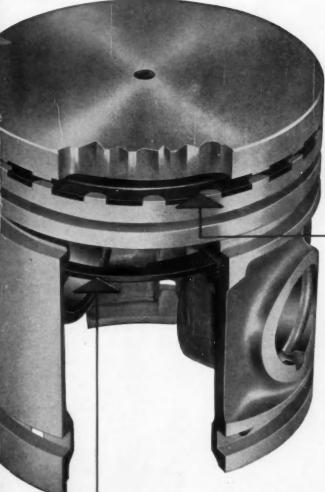
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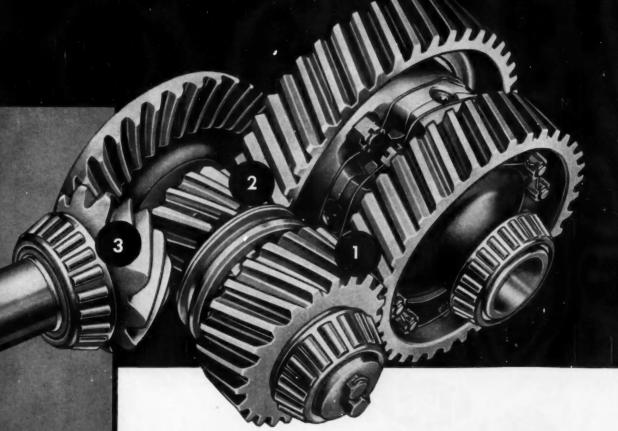
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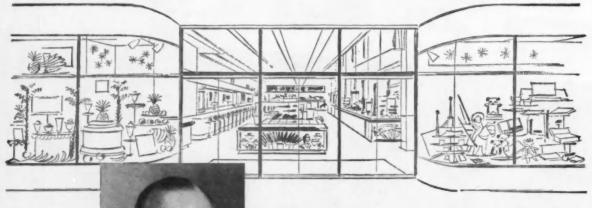


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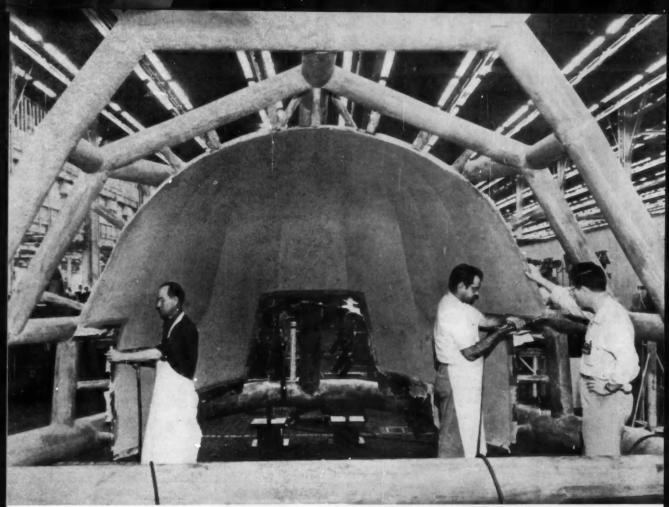


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City State	4	



WITH SEGMENTAL STEEL TOP RING SECTION

Again, Zollner engineering leadership provides another great piston development to engine builders. The new Zollner "Perma-Groove" gives sensationally longer life to pistons and rings, prevents blow-by, minimizes oil consumption. The light weight segmental steel section incorporates high wear resistance in the top ring groove plus the advantage of cool operation. Designed especially for gasoline engine pistons, "Perma-Groove" is the quality, low-weight and low-cost companion to the popular "Bond-O-Loc" piston for Diesel engines. We suggest an immediate test of "Perma-Groove" advantages for your gasoline engine.

*T. M. Reg. Pat. App. For



TOP RING SECTION



FRONT VIEW SECTION

OUTSTANDING ADVANTAGES
OF ZOLLNER "PERMA-GROOVE"
TOP RING SECTION



CROSS SECTION

- Individual steel segments eliminate continuous band expansion problem.
- Segments securely locked to prevent radial movement.
- Dovetailed edges keep steel segments securely in plane with groove.
- 4.75% steel bearing area for wear resistance.
- 25% aluminum bearing area for heat conductivity and cool operation.
- 6. Light in weight.

ADVANCED ENGINEERING PRECISION PRODUCTION COOPERATION WITH ENGINE BUILDERS PISTONS

ZOLLNER CORPORATION · Fort Wayne, Indiana

what makes this fastener DIFFERENT?



HOW YOU INSERT IT

Several things. Rollpin® is a slotted, chamfered, cylindrical spring pin which drives easily into a hole drilled to normal production standards. It locks securely in place, yet can be drifted out and reused whenever necessary. This eliminates special machining, tapping, and the need for hole reaming or precision tolerances. Rollpin replaces taper pins, straight pins and set screws; for many applications it will serve as a rivet, dowel, hinge pin, cotter pin or stop pin.

And here's another difference that makes Rollpin the quality fastener in the field: ESNA's qualitycontrol builds consistent strength and performance into every Rollpin. Rollpin is uniform as to shear strength, dimensions, hardness, and insertion and removal forces,



Drives easily by hammer, arbor press, or air cylinder and can be readily adapted to an automatic hopper feed. Requires only a standard hole, drilled to normal production-line tolerances. Locks securely in place without using a secondary locking device; won't loosen despite impact loading, stress reversals, or severe vibration. Removes readily with a drift pin without damage to pin or hole, can be used again and again in original hole.

HOW YOU SAVE

You pay less for Rollpins than for most tapered, notched, grooved or dowel pins. Installation costs are substantially less than for any fastener requiring a precision fit or secondary locking operations.

Because of their tubular shape, Rollpins are lighter than solid pins. Production maintenance is reduced with Rollpins: they do not loosen and because of their spring action they tend to conform to the drilled hole in which they're inserted, without material hole wear, eliminating the necessity of re-drilling or using oversize pins.

MATERIALS AND SIZES

Standard Rollpins are made from carbon steel and Type 420 corrosion resistant steel. They're also available in beryllium copper for applications requiring exceptional resistance to corrosive attack, good electrical, anti-magnetic, and non-sparking properties. Stock sizes range from .062" to .500" in carbon and stainless steels.





Dept. R40-75, 2338 Yauxhall Road, Union, New Jersey Please send me the following free fastening information

- Rollpin Bulletin
 Elastic Stop nut Bulletin
- Here is a drawing of our product. What self-locking fastener would you suggest?

State

me______Title___

Street____